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VOL. XIV. NEW YORK, SEPT. 14, 1889. No. 11.

Invading England. IT will appear from an item in our Western Notes that the Westinghouse invasion of England is being actively pushed, and that a large force has already gone over to put the new factory in operation. It is evident that Mr. Westinghouse is determined to enjoy a share of the work that must come from the electric light "boom," now assuming such vast proportions in England, and is preparing for it on a commensurate scale.

The Peral Submarine Boat. LAST week the New York *Sun* had an article, from which we quoted, alleging that the Peral electric submarine boat had proved a fizzle, and had sunk in Cadiz harbor while being tested before a gathering of Spanish dignitaries. The *Sun* now states, however, that there was no foundation for the story it published, but that on the contrary the boat has withstood a series of severe experimental tests, and "appears to be one of the most extraordinary developments in scientific naval warfare." If this be true, as we hope it is, Senor Peral will no doubt receive his due in praise and in more substantial recompense.

Friction Driving. THE question of driving dynamos by means of friction gearing is receiving considerable attention at this time on account of the great saving of space obtained thereby. It has been claimed that friction driving is very uneconomical, but if the results of the test of the new Evans friction belt method, which we publish on another page, are to be accepted, it is at least shown to be as economical as ordinary belt driving, and remarkably compact. We also publish a very interesting account of a complete new friction plant, especially designed for use aboard ship, which possesses some very marked and advantageous features. This Arnold plant, it may be noted, is that on board the yacht that has had the honor of entertaining President Harrison this summer.

Underground Work in Boston. ELECTRICAL companies in many of our cities are written of and treated as though they were so obstinately opposed to underground work that they would not even make an attempt to prove its feasibility. That this is not the sentiment animating the companies is a fact that deserves to be better known than it is. The money that has been spent by them in experiments would reach a very large sum, yet, though often discouraged by failure, they have never abandoned hope or endeavor. The interesting illustrated article that we publish in this issue on the work done by the New England Telephone Company in Boston is a striking evidence of the readiness to go underground with the wires, provided there is any promise of success. The company have not spared money, but have given the subject their close attention and spared no effort to reach satisfactory results. The details given of the methods adopted and favored for this class of work are worthy of note.

Circuits for Tesla Motors. IT is interesting to note the amount of ingenuity and inventive skill which is being expended on the practical development of reliable and commercially satisfactory alternating current motors. One of the objections to Mr. Tesla's alternating motor, which in theory is so beautifully simple, and requires no commutator or brushes, has been the increase of the leads to four or at least three, on account of the energizing currents calling for a difference in phase of one-quarter period. This, M. Leblanc suggests, can be obviated by employing a condenser and transformer, interposed in the circuit. In fact, we are inclined to think that there may be a great future yet for the condenser in electric light and power distribution. He also presents an ingenious plan for obtaining from an alternating current of one period a current of any other, which certainly has points of usefulness, as it may often be desirable to alter the rapidity of the alternations, especially in experimental work.

The Telephone Convention. THE telephone convention which takes place this week at Minneapolis, and begins after our present issue has gone to press, will doubtless be as pleasant as any of its predecessors. It may also be not less interesting to outsiders, but there is evidently, and naturally, a tendency not to discuss in public several of the vital topics of the industry. In fact, we should not be surprised to see the convention go into executive session with closed doors part of the time, after the manner of the Edison convention, which it resembles in many respects. The nearer the time comes for the expiry of the foundation patents, the less likely the telephone companies are to invite the public at large into their confidence. There are, however, a variety of topics that are not of a delicate nature, to crop up for discussion, and on these we may expect to learn something out of the mature experience of our telephonic friends, who have with such remarkable ability built up the magnificent telephonic industry of America.

Profit and Loss. A ST. LOUIS paper furnishes an elaborate statement indicating that the investments of her citizens in mining property have paid better dividends "than any other of their investments," and further shows that banking returned a net profit of only 12 per cent. on an investment of $15,000,000, while mining has paid back every dollar originally invested with an annual increase of 22 per cent. on $6,000,000 invested, the period mentioned covering three years. This is a good showing for both banking and mining, but is not equal to the average profits obtained from investments in legitimate electric lighting and power industries carried on in several cities, both in the East and in the West. One of these profitable plants was referred to in our issue of Aug. 24, and there are now in course of construction two large central station electric plants in the West, both of which should return ample dividends to the stockholders if properly managed. In the one case the contract for lighting the city has already been taken at a remarkably low figure, and some parties still question the possibility of the running expenses of the plant being met; but past experience in the management of large plants has shown that where judicious care is observed there is every possible security for reaping handsome dividends on the total amount actually paid in. And it is these very possibilities for good returns on safe investments that have prompted certain Englishmen to make special investigation, now fructifying, into the advisability of distributing a large amount of capital in electrical industries in the United States.

Lighting in the Navy. ENSIGN GILBERT WILKES, of the United States Navy, in the issue of "Naval Mobilization and Improvement in Materiel," of June, 1889, in considering the use of electricity on board men-of-war, mentions an interesting method of inserting resistance in the shunt circuit of the compound-wound 80-volt machine to reduce the pressure to the necessary 50 volts for one lamp in circuit, or about 53 volts with two, in lieu of placing a large amount of dead resistance in the lamp circuit, thus maintaining the efficiency at about 70 per cent., as against 48 per cent. when employing dead resistance. In addition, he mentions an ingenious modification of the search light to assist the dynamo in striking the arc. It consists of a solenoid traversed by the current from the lower carbon holder, which attracts an armature rigidly fixed to the lower carbon holder against the pressure of a spring. He further remarks on the many advantages that would accrue from an absolutely reliable storage battery, enabling motors to be employed more generally in place of small steam engines on shipboard, as then the energy to be developed by the generating plant would be evenly distributed throughout its hours of running.

Wanamaker's "Mark Down" Telegraphs. THE desire of the Postmaster-General to furnish cheaper telegraphs, as shown in the scheme published last week, is most laudable, and it is generally conceded that the scheme has merit. It ought certainly to increase facilities, to employ postal agencies and stations, and this increase of facilities ought in turn to bring lower rates with the larger business. We note, however, that Superintendent Gill, of the Western Union Company in Philadelphia, sees many practical objections to the project. He doubts whether people will care to wait for a letter carrier in either sending or receiving a telegram, and he thinks, moreover, that dispensing with messenger boys and relying on letter carriers would really prove more expensive for "there would be no economy in using the men for work which the boys can do just as well." Still, a modification of the plan may meet just these points raised by Mr. Gill. For example, by working the messenger boys in for collections and delivery, the mail service might be expedited. In the big cities the hourly collections could thus be made half hourly, and that would certainly suffice in the case of a great number of telegrams; while the deliveries could also be made more frequently through the dovetailing of the two services. Anybody who wanted a telegram expedited could still send it "special" at a higher rate. We believe that with cheap "postal telegrams," a great many people, where the mail could not reach the destination the next morning, would avail themselves of the new service, provided, of course, its rate was low enough to act as an inducement. In this way much correspondence, for instance, between New York and Chicago and other points more than a day's mail off, could be accelerated. There would thus be a great deal more "red" business than heretofore. Various other points suggest themselves, but it may be well to await the full details of the scheme.

Electrical Work in the Navy. THE volume just issued by the Office of Naval Intelligence, on "Naval Mobilization and Improvement in Materiel" is not less valuable and interesting than that of last year to electricians. As in the issue of 1888, a section is specially devoted to the use of electricity in the United States Navy. To this section the contributors are Commander R. B. Bradford, Ensign Gilbert Wilkes, Lieut. T. E. DeWitt Veeder and Lieut. R. C. Smith, who between them manage to treat nearly all the questions of any real importance, and who bring out a great many valuable ideas and suggestions. The summary which Commander Bradford, as Naval Inspector of Electric Lighting, makes of the work of the year, calls attention to the equipments adopted for foreign men-of-war, and says that their chief lesson is that manufacturers must be prepared to supply plants that can be contained in such spaces on shipboard as are available for them. This is, after all, the main consideration. It is encouraging to learn from Lieutenant Veeder's report that American apparatus is in this respect improving rapidly, and showing much progress in efficiency and security, the speed of running having been decreased, while the output of the machines has risen, and the heating has been cut down to a practicable minimum. Various other improvements are indicated in insulation of conductors, nature of fixtures, etc. With regard to insulation of conductors, Lieutenant Smith presents an interesting statement, and he claims that, "in the ships of the Navy now wiring, a point of excellence will be attained not hitherto excelled and infrequently equaled." Ensign Wilkes, in his report, besides dwelling on dynamos and lamps, has a good word to say for the electric motor, but he is anxious to see the motor supplemented by a good storage battery, and he instances the Desmazures alkaline type lately put on board the French submarine torpedo boat "Gymnote." He again dwells on the storage battery in speaking of the new work that opens up in connection with the use of electricity in navy yards and naval shore stations. Altogether these reports are highly suggestive, and form a creditable addition to electrical literature.

"ELECTRICAL WORLD" PORTRAITS.—VIII.

THOMAS D. LOCKWOOD.

Few men of prominence in the electrical profession have had a career of such kaleidoscopic variety as Mr. Thomas D. Lockwood, who, while an Englishman by birth, has shown more than the versatility of the typical Yankee, and who to-day is universally recognized as a "past-master" in an intricate art peculiarly American in its development and appliances. There are certain traits in Mr. Lockwood's character that would cause us to expect that once engaged in an occupation he would have remained in it even if he had been its last practitioner; yet there are other elements, not necessarily opposed, but complementary, that have led him on from success to success in different fields, and that within the last few years have brought him to his enviable position in the telephonic ranks.

Thomas D. Lockwood was born in Birmingham, England, Dec. 30, 1848, and he is consequently over 40 years old. He had a very slender school education to start with, and began work for a living in 1859. His first employment was washing emery for use in the manufacture of plate glass at the Birmingham Plate Glass Works, after a year of which he entered the machine shops of the manufactory and worked there, learning and practicing the trade of machinist, until 1865, when, with his father's family, he sailed for North America. Reaching these shores, he resided for some time at Port Hope, Ontario, Canada, where after a short spell in a machine shop and a tannery, he learned the art of telegraphy. He became the first operator at Port Hope for the Provincial Telegraph Company, a short-lived concern afterward swallowed up by the Montreal Telegraph Company. Thrown out of employment in 1867 by this consolidation, young Lockwood, unwilling to be idle, took the first work that offered, and became a finisher in the paper mills of the Smith Paper Company, of Lee, Mass. It was thus that by naturalization he became one of the now famous electrical brotherhood of the Berkshire Hills, which includes Stephen D. Field, the Pope brothers and others.

In 1869 Mr. Lockwood, ever on the watch for opportunity, went west to New Albany, Ind., where he aided in the establishment of a manufactory of polished plate glass. This was the first concern of the kind in the United States, and Mr. Lockwood wrote the order to England for the importation of the first machinery used in this country for the purpose. This factory afterward developed into the Star Glass Works, where the late W. C. De Pauw made some of the millions with which he endowed so liberally the De Pauw University. It was at New Albany that Mr. Lockwood made his début in literature, by contributing to the *Scientific American* an excellent four-column article on the manufacture of plate glass.

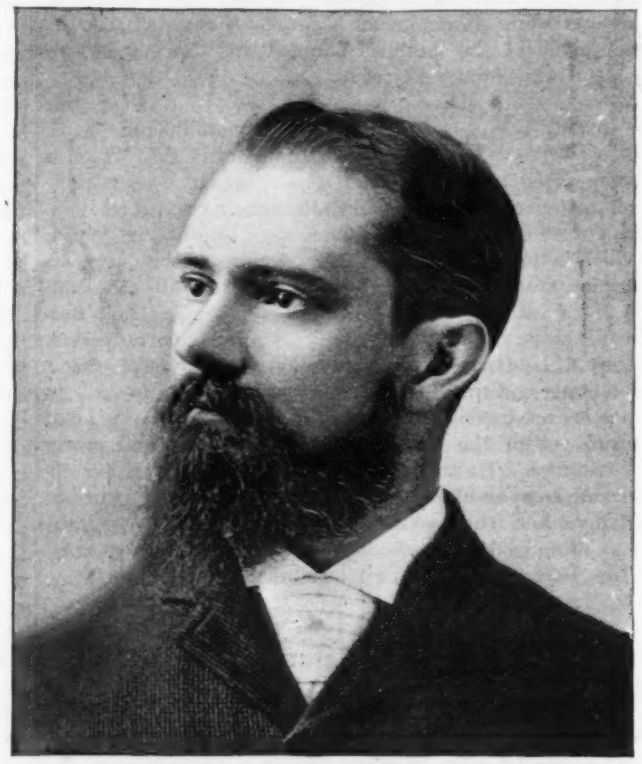
In 1872 Mr. Lockwood came East again, working his passage, and engaged in the employ of the Housatonic Railroad, serving consecutively as ticket clerk, freight clerk and telegraph operator at Lee and Bridgeport, and as chief clerk and paymaster in the master mechanic's department, besides acting on trains in various capacities, from brakeman to engineer. Mr. Lockwood could easily have written the whole "Railway Series" for *Scribner's Magazine*, his multifarious occupations in the railway field winding up with the duties of signal operator at Morristown, N. J., for the Delaware, Lackawanna & Western Railroad Company.

Coming to New York in 1873, Mr. Lockwood engaged with the Automatic Signal Telegraph Company, a private fire alarm service, as inspector; and he was then called to positions of higher responsibility with the Gold and Stock and American District Telegraph Companies. At this time —1874 to 1877—these companies were the best schools of practical telegraphy in the country, and Mr. Lockwood, always anxious to learn, proved an apt scholar. It was here that he gained the immense experience in the management and arrangement of circuits that made him invaluable when the telephone was introduced.

One of the effects of the invention of the telephone by Professor Bell was to drain the telegraphic field of many of its best and brightest spirits, and it was thus that, in 1879, Mr. Lockwood came to accept a position with the National Bell Telephone Company, which a little later organized as the American Bell Telephone Company. For some time he acted as technical inspector of exchanges, but in 1881 the company decided to organize a Patent and Technical Information Bureau, at the head of which Mr. Lockwood was placed. Here he was emphatically the right man in the right place. At the present time he has charge of the Patent Department of the American Bell Telephone Company at the headquarters in Boston, acts as one of the electricians of that company, and also as advisory electrician for the Bell Telephone Company of Canada. It is needless to say that the duties of such positions involve the exercise of many rare and special qualities, and exact an unremitting attention to subjects of the utmost importance.

A word is now due to Mr. Lockwood's literary labors. One of the first of his sustained efforts was the "Notes and Queries" published chiefly in *The Operator*, the predecessor of The Electrical World, and afterward incorporated in his book "Electricity, Magnetism, and the Electric Telegraph." The next was a series of valuable articles specially relating to practical telephony, also published in *The Operator* and issued in book form as "Practical-Information for Telephonists," which has had a large circulation, and is highly appreciated to this day. The third noteworthy production is the well-known "Text-Book of Electrical Measurements." Mr. Lockwood has also contributed to this journal and others almost innumerable articles and series of articles not simply on telephonic topics, but on subjects of general and vital interest to electricity at large. Mr. Lockwood has a happy style, with frequent touches of humor, and great felicity of quotation, while he always has "a message," and says his say in so forcible a manner that it is rarely forgotten by the reader. It is, moreover, one of the things to Mr. Lockwood's credit that he has gradually got together a most valuable technical library and a mass of electrical information, especially telephonic, that has to be seen to be appreciated. In connection with Mr. Lockwood's literary work, it may be mentioned that he has a stupendous memory—one of those memories that acts instantaneously and seems to have its stores wholesale and illimitable, but ready for delivery on call in the smallest as well as the largest packages. His gift of expression in writing is matched by unusual ability in extemporaneous speaking. Mr. Lockwood denies, however, that he has any marked talent, and always avers that if he has accomplished anything it has been done by sheer energy and perseverance.

Besides working and writing, Mr. Lockwood has found time for a little inventing. He has taken out 22 patents in all, in 19 of which he appears as the sole inventor. All are for telephones and telephonic appliances but two, these latter being for a burglar alarm and a district system. It was also Mr. Lockwood who first applied the Wheatstone bridge system to the burglar alarm service. Mr. Lockwood is an honorary member of the National Telephone Exchange Association, and a foreign member of the English Institution of Electrical Engineers. In 1884 he was, by request, one of the authors of papers read before the International Electrical Conference at Philadelphia. In the winter of 1885, he was lecturer before the celebrated Lowell Institute on telegraphy and the telephone. He was a charter member of the American Institute of Electrical Engineers, has served as vice-president and is now one of the Board of Managers of that society. In 1875 Mr. Lockwood was married to Miss Mary Helm, of Port Hope, Ont. He has one son twelve years old.



THOMAS D. LOCKWOOD.

Circuits for Tesla Alternating Motors.

M. Leblanc, a French electrician, makes an ingenious suggestion in the London *Electrician* for the suppression of the double set of leads of the Tesla motor. He says that it is only necessary to take a transformer and equilibrate the self-induction of its secondary circuit (including in this, of course, the external circuit) by interposing a suitable condenser. The current in this circuit will then be displaced in phase by precisely one-quarter wave length over that of the primary.

The primary coil of the transformer is placed in circuit with one set of the Tesla field coils, the ends of this circuit being connected directly to the two main leads; the secondary is connected with the other field circuit, a suitable condenser being interposed between secondary and set of field coils, and the ends of the circuit are connected together.

We can also, if desired, go a step further and balance the self-induction of the primary also, so as to suppress the apparent increase of resistance of the system with respect to the generator.

Another highly novel suggestion is as follows:

Having an alternating current of given period, to obtain a current of any other required period.

To do this, take a Gramme ring and divide the coils into three circuits *a*, *b*, *c*, in such a way that every alternate coil all round the ring is in circuit *c*, while the remaining coils in each alternate quadrant belong to circuits *a* and *b* respectively. In fact, so far as *a* and *b* are concerned, the circuits are placed exactly as in the Tesla motor, while a coil of circuit *c* intervenes between every pair of coils all round. Through circuits *a* and *b* two independent alternating currents are sent, which differ in phase by 90 degrees again as in the Tesla motor. The coils of circuit *c* are connected to the bars of a Gramme commutator, and upon this, according to M. Leblanc's solution, a pair of brushes is caused to rotate. Now, while the brushes are at rest, the coils *c* are the seat of an induced E. M. F. equal in period and midway in phase to that of the currents in *a* and *b;* but now, if the brushes rotate upon the commutator, it is easy to see that the period may be either diminished or increased according to the relative velocity of the brushes as compared with that of the virtual rotation of the poles in the ring caused by the current *a* and *b*.

More About the Author of "Electron."

To the Editors of The Electrical World:

I notice in the last number (Aug. 24) of The Electrical World, a request from "Bookworm" for some information of W. C. Richards, author of "Electron."

Prof Wm. C. Richards, A. M., Ph. D., has for many years stood among the most brilliant and fascinating lecturers in physical science, having delivered courses of scientific lectures in nearly all the pricipal cities of the United States, besides being a very popular lecturer at Chautauqua assemblies, etc. He is also both a prose and poetical author. His most popular work, and one of his earliest, is perhaps "Harry's Vacation," a book highly adapted to interest young people in natural science. His latest publication is "The Apostle of Burmah," a history in verse of the life and works of Adoniram Judson.

Professor Richards, though crowned with gray, still retains the buoyancy of youth, and continues, aided by the finest physical apparatus in America, to charm his audiences by the brilliancy of his wit and magnificent scientific demonstrations. He is also a member of the firm of H. V. Richards & Co., manufacturers and importers of scientific apparatus, at 3,225 Cottage Grove avenue, Chicago, Ill.

J. R. Eaton, Prof. Nat. Science.
William Jewell College, Liberty, Mo.

The "Teutonic's" Electric Plant.

The magnificent new steamer "Teutonic," of the White Star line, is equipped with electric lights and appliances worthy of special notice. Four Crompton dynamos, run by four Tangye direct-acting compound engines furnish the ship with 1,300 16 c. p. Edison-Swan incandescent lights, two 110 c. p. lamps and one 20,000 c. p. search light, the latter being of very fine construction. There are also on board 10 small C. & C. motors used to run fans for the purpose of ventilation. Push buttons are in the ladies' room, dining-room, library, lavatories—in fact everywhere for the convenience of passengers.

The wiring, etc., was done by the Liverpool Electric Supply Company, and a fine piece of work it is. Mr. Wm. Atkinson, the electrician of the steamer, takes pleasure in showing visitors the beauties of the plant.

Subway Methods in Brooklyn.

With regard to the recent report on the explosions of gas in the electrical subways of New York, an article in the *Engineering and Mining Journal*, probably written by its editor, Subway Commissioner Raymond, of Brooklyn, says: "Send your sub-committee over to the slow city of Brooklyn, with instructions to inquire into the obscure but pertinent fact that somehow or other those Brooklyn subways are not explosively conspicuous, although there is plenty of gas in the Brooklyn soil. Bid them follow their noses into the big tunnel through which thousands of miles of underground conductors enter the basement of the telephone exchange building and report whether they smell any gas. Then let them meekly go up stairs and ask Mr. Sargent how he manages it. They will find that he employs neither of the four systems of their exhaustive classification, but a fifth, which they have overlooked, because it was so simple and easy and close at hand. When he takes a cable from a subway he runs it up through a box which acts as a chimney; and the small amount of gas which may leak into his conduit leaks out again up chimney. Of course, this is all highly absurd and inadequate as a remedy for 'New York conditions.' But it is worth the attention, nevertheless, of those eminent experts, Mr. Gilroy and Mr.

Gibbens, who compose the committee of the New York board."

Underground Construction Work of the New England Telephone and Telegraph Company.

In a city the size of Boston, within whose borders the unsightly poles, so common in other cities, have been proscribed, the question of providing an adequate receptacle for wires naturally becomes very important. The housetops are limited, and it is not always that permission can be obtained to utilize this means. The underground solution is the only feasible one, and the New England Telephone and Telegraph Company as far back as 1882 arriving at that wise decision, decided to make the experiment on a sufficiently large basis to determine its success or failure. In 1882 there was laid about 1,200 feet of 8-duct conduit in Pearl and Congress streets, and about 700 feet of 6-duct conduit in Franklin street. These conduits consisted of 3-inch iron pipe and cement concrete, practically similar to the conduits being laid to-day, which are described further on in this article, making in Pearl and Congress streets a conduit of 2¼ feet wide and 1¼ feet high. It is interesting to note that samples of the pipe taken up recently show that the iron pipe is perfectly intact and entirely free from rust, proving the value of the concrete surroundings.

In order to test the value of this experiment nothing more was done for four years, and underground work was not resumed until the summer of 1886, when 1,400 feet of 6-duct conduit was laid in Berkeley street, made of creosoted pine. In the fall of that year, 5,300 feet of 12-duct conduit was laid, also of creosoted pine, connecting the Pearl street office with the Tremont street office, and 2,800 feet of 9-duct conduit, making a total of 8,000 feet of conduit with 30 manholes, and giving 8,800 feet of duct at an approximate cost of $23,000. In 1887, over 10,000 feet of 9-duct conduit was laid, and this was also composed of creosoted pine. During the season of 1888 the underground system was nearly doubled in capacity, and in February, 1889, the total amount of conduit underground consisted of 2,617 feet of conduit, of iron pipe in concrete, averaging from 4 to 33 ducts, and making a total of 50,000 feet of ducts; and 43,157 feet of creosoted wood conduit, averaging from 6 to 36 ducts, with a total of 445,000 feet of duct. This gives the grand total of 8⅔ miles of street conduit and 93⅔ miles of duct. During the past year, about 16,000 feet of conduit has been laid, in the construction of which 41,000 feet of cement-lined iron pipe, furnished by the National Conduit Manufacturing Company, of New York, and 80,000 feet of 3-inch casing iron pipe, furnished by the National Tube Works, of Boston, and Morris Tasker & Co., of Philadelphia, has been used. The creosoted wood conduits were laid in as substantial a manner as possible, the material being of North Carolina hard pine, 2 inches thick for top, bottom and sides, and 1 inch thick for inside partitions, containing about 12 pounds of creosote oil to the cubic foot—the life of which is estimated from 25 to 50 years. The conduits were built of 16-foot lengths, the joints being covered with several layers of tar paper and pitch. The size of the duct was 2½ inches square. Waterproofness was aimed at, both in the creosoted wood and the iron pipe conduits, but the cables were made thoroughly insulated and protected by lead pipe. It has now been practically decided that an absolutely insulated conduit is an impossibility, and as the cables themselves have done their work well, it has been decided to abandon for the future the cheaper work of creosoted wooden conduits, and provide for the cables, which are practically perfect, a thoroughly strong mechanical conduit worthy of them, and which will not rot away in a number of years. The creosoted wood was found also to have a deteriorating effect on the life of the cables.

A brief description of the method of laying the iron pipes may be found interesting. To form a conduit of 20 ducts a ditch is dug about 3½ feet wide by 5 feet deep, from one manhole to another, a distance of probably 500 feet. Creosoted boards are placed on edge about 3 feet apart to form the sides of the conduit, and in the bottom of the ditch is laid a concrete floor about 3 inches thick. When the cement is set, the first course of pipes is laid, screwed together like gas service pipes, with leaded joints, and then carefully placed in the trench and spaced by wooden templates, which are taken up after the concrete is put in. There is a 3-inch space between the pipes which is filled in with concrete, and another layer of concrete 3 inches thick is placed in on top, forming a floor for the next layer of pipes. On top of all is placed a 2-inch creosoted plank, and then the dirt is filled in. The conduits made of cement lined pipe are laid practically in the same manner. The concrete used in this work is especially strong, making a thoroughly impenetrable concrete conduit. The proportions are: one part of American hydraulic cement, one part clean sharp sand, and two parts of cracked stone. The manholes are about 500 feet apart, and are brick chambers averaging 5 feet square and 7 feet deep, wtth walls of from 8 to 12 inches thick. Instead of being tapered or bottle-shaped at the top, they are provided with a North River flagging stone resting on iron beams, on which sits the cast-iron double cover. The probable approximate cost of this kind of underground work, inclusive of manholes, is about 50 cents per foot per duct.

FIG. 1.—DRAWING IN A TELEPHONE CABLE, BOSTON.

The cables used are all lead-covered, and vary from 50 wires to 200 wires. Only two manufactures are used, those of the Western Electric Company of Chicago, and the American Electrical Works, of Providence. About one-half of the telephone wires in the city are now underground. The telephone company possess a capacity underground for 14,000 miles of wire, and they actually have in working condition about 3,000 miles of wire. They propose in the near future to have all the telephone wires within the city limits underground where practicable, and are making a special point of providing all important new buildings with underground connections to their conduits, so that a special cable may be run to each building of importance. In Boston there are now several large buildings which are thus connected, having no ærial connections whatever, all the wires being brought into the basements, and distributed therefrom among the various floors. The New England Telephone Company are making strenuous efforts in this direction, and are gradually working out a scheme by which all important lines will be underground, and the distribution wires alone left overhead. As soon as it is possible to get special underground cables to all the large buildings, even these overhead wires will gradually disappear, and Boston streets will be free from them.

The New England Telephone Company are certainly to be congratulated on their energy in this direction, and we expect that in due course many other cities will soon follow in their wake, until there will be no necessity for underground legislation, on account of the companies having voluntarily chosen that means of reaching their customers with least trouble, and eventually with least expense.

In our illustrations, Fig. 1 represents a gang of men drawing in a 60-paired cable in Congress street; Fig. 2, the drawing-in rope and winch; Fig. 3, the interior of manhole, showing iron pipe and cement conduit, and creosoted wood conduit; Fig. 4, work of construction on School street, and a few of the difficulties to contend with—gas pipes, Edison tubes, junction boxes, feeder box, etc.; Fig. 5, cable shaft, where underground cables are led from the cellar to the operating room in the top of the building; Fig. 6, terminal heads of cables in tower, where the cables are fanned out and connected through fusible protectors to flexible cables leading to the switchboard in the operating room below.

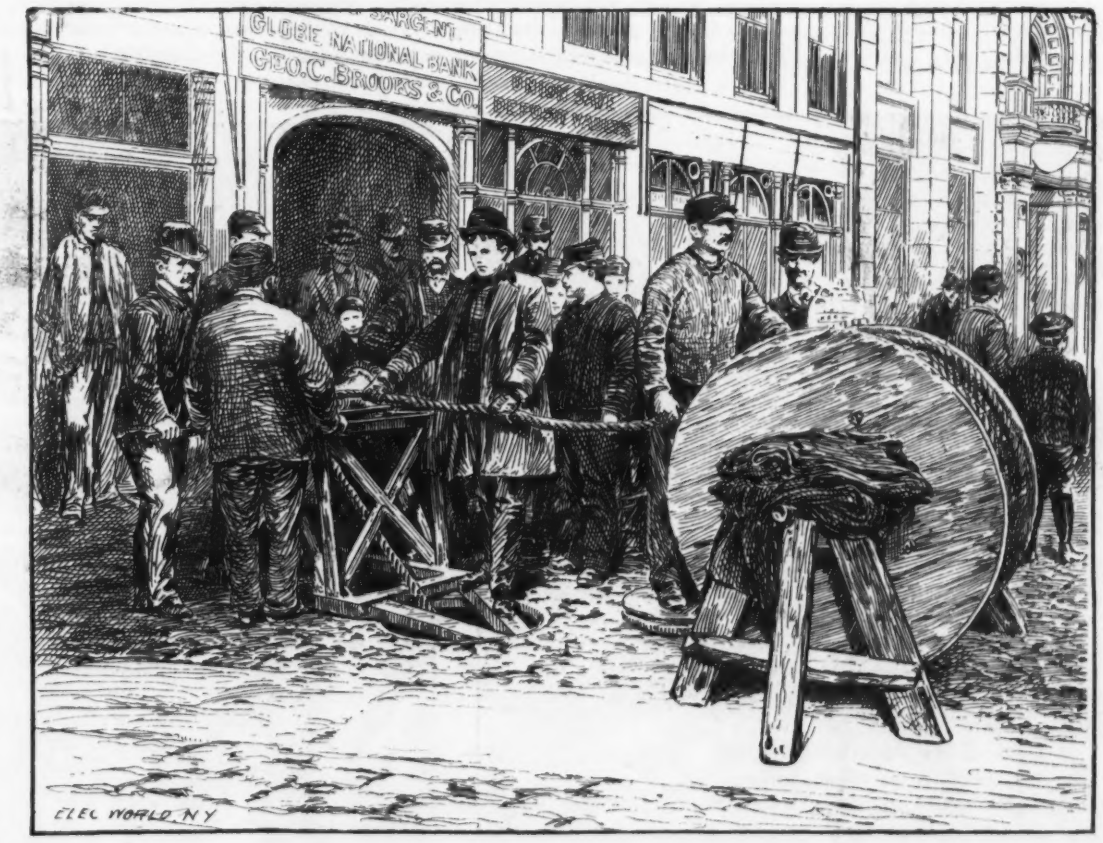


FIG. 2.—DRAWING-IN ROPE, AND WINCH.

An Improved Magnet Spool.

When magnetos, bells and annunciators require repairing it has often been found necessary to rewind the spools or coils used, simply because the end of the inside wire had broken off close to the fibre head, although handled quite carefully. This is probably due to the fact that the fine wire exposed becomes "set" or hardened after much usage and breaks on slight pressure. To obviate this trouble, Mr. George D. Clarke, of Chicago, has devised and patented an improvement consisting of a magnet spool, the head of which contains a groove of sufficient depth to permit of

several turns of the inside end of the wire being first wound therein, thus enabling the repairer to utilize the original winding many times over.

Permanent Magnets in Pole Pieces.

To the Editors of The Electrical World:

I find under the heading, "A Few Electrical Conundrums," on page 167 of your last issue, which just now comes to hand, the following question: "Is there any dynamo or exciter that has small permanent magnets in the pole pieces to start excitement?" and the answer given is: "We have not heard of this method being employed, and fail to see the necessity, as the residual magnetism contained in the iron of the field magnets in a properly designed machine, is ample for this purpose."

Allow me to remark in relation to this that Weston was perhaps the first who found the necessity of such an arrangement, when, many years ago, his chief occupation was to make dynamos for electro-plating. He found that whenever the dynamo was stopped before the circuit was broken (for instance, by the accident of the slipping off of a belt) the plating bath acted as a storage battery and sent an opposite current through the arrested dynamo, which at once reversed its polarity, so that when started again the consequently reversed current would dissolve and seriously damage the objects to be plated. He arranged, therefore, an automatic cut-off, intended to operate when the rotation was arrested, but its action not being instantaneous enough, he provided the sides of the soft iron cores of the ring field magnets with steel plates, which, being permanently magnetized, were intended to prevent the reversion of polarity by the reflex current of the plating bath. I saw these dynamos and their interior construction more than ten years ago in his shop in Newark, and find the description, with special mention of the steel magnets, in Schellen's "Magneto und Dynamo Maschinen," Cologne, 1882, page 112.

As the steel plates were inside the coils, it happened that when the bath was strongly polarized its reflex current reversed even the poles of these steel plates. Hence, other makers have adopted the improvement to make elongated pole pieces of steel and permanently magnetized, being placed outside the coils and thus beyond their influence. On this principle many small dynamos have been constructed and are in use by electrotypers and platers.

That this device is well known, appears from Silvanus Thompson's excellent book on "Dynamo Electric Machinery." In the chapter on constant potential distribution he gives four methods by which this can be attained, of which I will quote only the first:

"*Series Regulating Coils and Permanent Magnets.*—If the field magnets are partly permanently magnetized, or if there are permanent steel magnets in addition to the electro-magnets, giving a partial permanent field, independent of that due to the current in the circuit, we may denominate the number of magnetic lines in this independent field as *N*, etc."

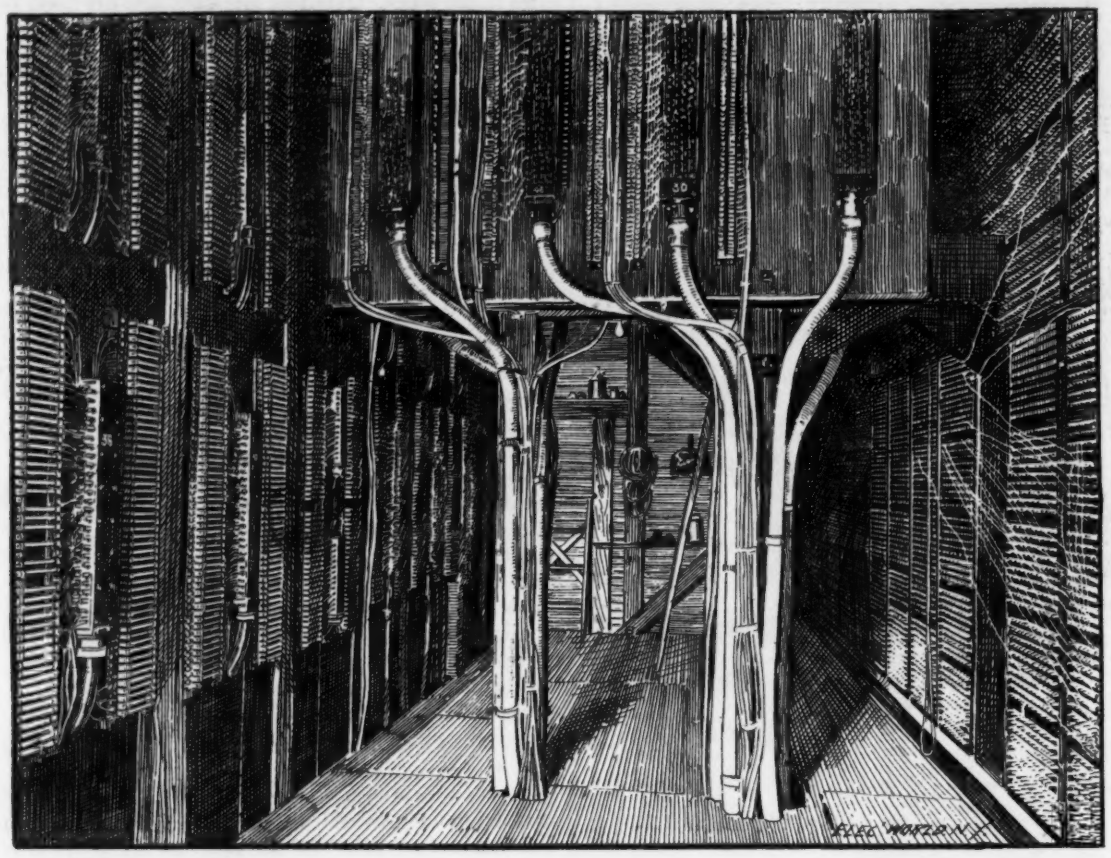
He further explains how the fundamental equation for the series dynamo is modified by having the number of magnetic lines made up of two parts, the permanent independent part *N* produced by the steel magnets and another part depending upon the current.

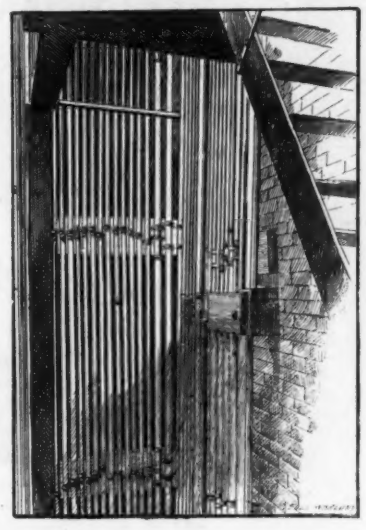
He gives then the algebraic equations with their deductions, and finally the geometric demonstrations, for which I refer to his book, pages 419–426 of the London edition for 1888.

P. H. VANDER WEYDE.

BROOKLYN, N. Y., Sept. 5, 1889.

[We are glad to publish this interesting letter, but would point out that no evidence is adduced as to the permanent magnet being *inside* the pole pieces—which is the question raised.—EDS. ELECTRICAL WORLD.]



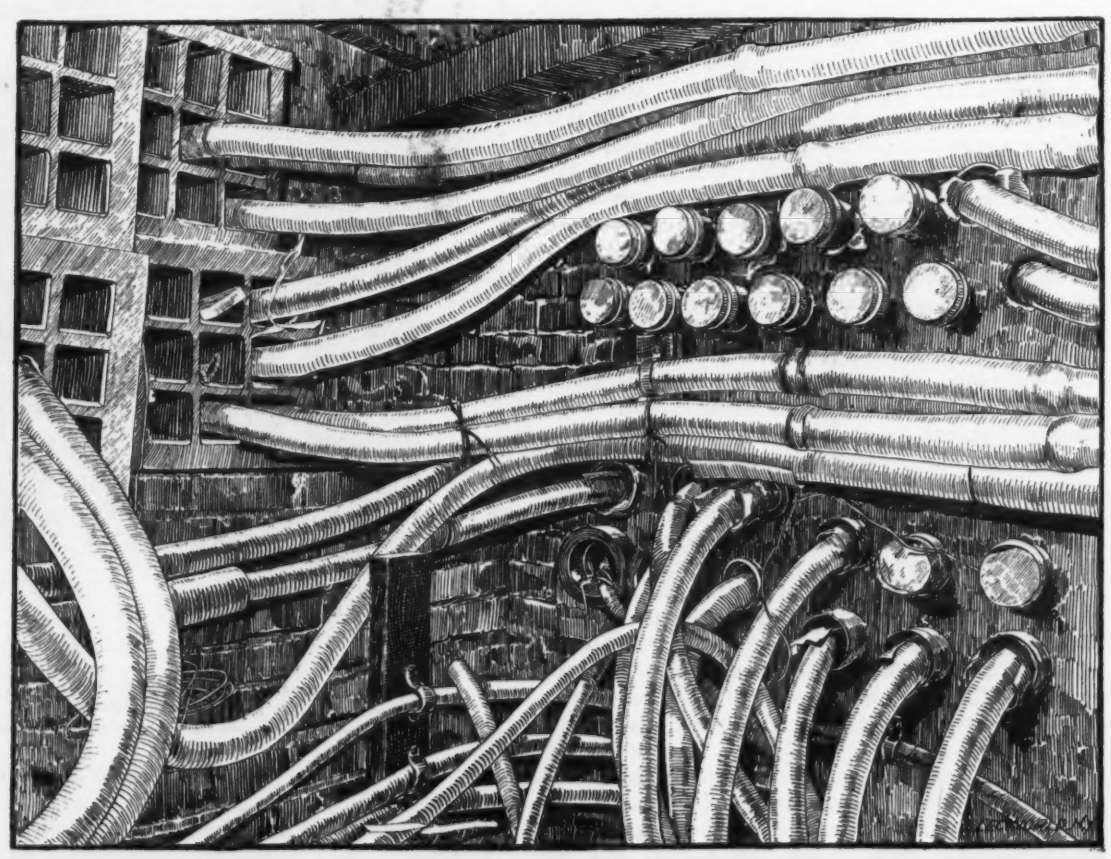


FIGS. 5 AND 6.—CABLE SHAFT AND CABLE TERMINALS IN TOWER.

Officers for the American Association for the Advancement of Science.

The meeting of the American Association was continued at Toronto last week. At the session on Sept. 3 the following officers for the ensuing year were unanimously elected: President, George L. Goodall, Cambridge, Mass.; Vice-Presidents, S. C. Chandler. Cambridge, Mass., mathematics and astronomy; Cleveland Abbe, of Washington, physics R. B. Warder, Washington, chemistry; James E. Denton, Hoboken, N. J., mathematical science and engineering; John S. Brauner, Little Rock, Ark., geology and geography; C. S. Minot, Boston, biology; Frank Baker, Washington, anthropology; J. R. Dodge, Washington, economic science and statistics; Permanent Secretary, F. W. Putnam, Cambridge, Mass.; General Secretary, H. C. Bolton, New York; Secretary of Council, James Landon, Toronto; Treasurer, William Tilly, Mauch Chunk, Penn.

The association will meet next year at Indianapolis on the third Wednesday in August.



FIGS. 3 AND 4.—STREET WORK AND INTERIOR OF MANHOLE.

Attending the New York World's Fair.—The Toledo *Blade* hopes that the proposed electric railway, which will run between New York and Chicago in three hours, will be completed and in operation by 1892. This will enable New Yorkers or Chicagoans to attend the World's Fair daily.

Edison and His Inventions at the Paris Exposition.—III.

BY W. J. HAMMER.

(*Copyright*, 1889.)

THE TASIMETER.

The tasimeter is another invention of Mr. Edison's, which employs carbon arranged as a variable resistance. It has been named by him from the Greek, meaning "extension" and "measure," because the effect is primarily to measure extension of any kind. The apparatus, as shown in Nos. 2 and 6, Fig. 8, was used at Rawlins, Wyoming, during the solar eclipse of July 29, 1878, for the purpose of measuring the heat of the sun's corona. These tests were not entirely successful, but the preparatory tests, made upon the evening of July 27, in measuring the heat of the rays of light from the star Arcturus, were eminently satisfactory. It consists of a strip of vulcanite pointed at the ends and resting perpendicularly upon a platinum plate, below which is placed a carbon button, which in turn rests upon a similar plate of platinum. These plates represent the electrical circuit of the apparatus with the carbon interposed. The hard rubber is exceedingly sensitive to heat, which causes it to expand, creating a pressure upon the carbon button and a consequent reduction in the resistance, and that of the circuit in which it is interposed. The upper end of the vulcanite strip is held in place in the end of an adjustable screw, which admits of a regulation of the pressure upon the carbon button.

This instrument in point of application, is similar to the sensitive thermopile, although it is far more sensitive, as tests have shown that with a common form of galvanometer in circuit, the heat of the hand held several inches in front of the instrument, was sufficient to cause a deflection of several degrees, whereas a hot poker in front of a thermopile produced no effect when connected with the same galvanometer. Employing a Thomson mirror galvanometer, the spot of light is thrown completely off the scale, upon passing the hand in front of the tasimeter at a distance of 30 feet. In one experiment the heat from Mr. Edison's little finger produced an effect six times greater than a hot iron held at a corresponding distance away from the thermopile.

THE ODOROSCOPE.

The odoroscope, an application of the principle underlying the tasimeter, was shown in Fig. 8, diagram 8, in which a strip of gelatine takes the place of the vulcanite. It is sensitive not alone to heat, but also exceedingly sensitive to moisture, a few drops of water dropped upon the floor in a room containing the instrument sufficing to throw a spot of light off the scale when projected by a Thomson galvanometer in circuit with it. The carbon button is employed in a manner similar to the tasimeter arrangement. Barometers, hygrometers, and similar instruments of great delicacy, can be constructed upon this principle, and it may be employed in determining the character or pressure of certain gases and vapor in which it is placed.

This may be accomplished by coating the vulcanite or gelatine strip with substances which insulate and render it rigid, which substances are soluble in certain gases or vapors. Upon the instrument being exposed to such gases or vapors the coating becomes softened, which makes the strip sensitive, and indicates, by a galvanometer in circuit with it, the pressure or volume of the gas or vapor.

THE EDISON MICROPHONE.

Diagram 7, Fig. 8, represents a form of Mr. Edison's microphone for increasing the loudness of sound by multiplying the number of contact surfaces. It consists of four pieces of carbon, each supported by an upright steel spring; a fifth piece of carbon is attached to the centre of the diaphragm of sheet iron; against this carbon rests the second, which is pressed against lightly by the third, and that by the fourth and so on. The circuit being completed through the carbon semi-conductors, a Bell telephone is introduced into the secondary circuit of the induction coil, and any sound affecting the microphone is greatly magnified in the telephone receiver.

THE INCANDESCENT LAMP.

In no department of his work has Mr. Edison spent as much time and energy as in developing incandescent lighting, which he may be fairly called the "Father" of. Edison does not claim to be the first man who ever made an incandescent lamp, but he has clearly demonstrated that prior to his work nothing which could be considered in any respect a practicable or commercial lamp had ever been made, and it was not until his radical departure in the employment of a "high resistance filament" that the problem of subdivision, heretofore declared absolutely impossible, was demonstrated as feasible. I wonder how many here appreciate what Edison's filament patent really means. It is not a patent for a filament solely, but for that fundamental feature covering all incandescent lamps in use, *i. e.*, a filament of *high resistance*.

Let me explain in a few words what this is: a solid carbon filament, such as one cut from a block of dense carbon, could not by its nature make a commercial lamp, as it could not be of high resistance, but cellulose and vegetable fibres which in carbonization and treatment on the pumps throw off a very large proportion of volatile matter, leave a cellular structure behind, which is the feature of paramount importance in the incandescent lamp, and it is to that that its resistance is due. This is Mr. Edison's discovery, and his patents thoroughly cover it.

Mr. Edison was first lead to turn his attention to incandescent lighting by some experiments in arc lighting with the Wallace-Farmer lamp and dynamo, which he saw on a visit to Wm. Wallace, of Ansonia, Conn., one of the pioneers in arc lighting in this country. Edison said, "Wallace, I think I can beat you making electric light; you are on the wrong track." He returned to Menlo Park and commenced elaborate experiments upon platinum, iridium, and other metals, from which he found he could make practicable high candle power incandescent lamps by his method of changing the character of the metal by tempering and driving out slowly the occluded gases in the metal.

Diagram 1, Fig. 13 shows a representative type of this earliest form with its thermostatic regulator attachment. Diagram 2 represents another style in which he employed a spiral of platinum iridium wire wound on a cylinder of pipe clay, and covered with oxide of zircon; later he tried thread rubbed with plumbago, coal tar and similar substances. Diagram 3 shows his carbon spiral, the next important step, and in diagram 4 is shown the celebrated paper horseshoe lamp, which was the step which carried him far on his way toward the goal he was striving day and night to reach, *i. e.*, the complete solution of the economical distribution of light by electricity. In his experiments, upon which Edison expended upward of $100,000, he employed every substance he could find in the animal, mineral and vegetable kingdoms, and sent special envoys to South America, Central America, West Indies, China, Japan, India and elsewhere to find for him a perfect fibre for the carbon of his incandescent lamp.

He found, among other things, that there were no less than 1,200 varieties of bamboo, of which only 300 were useful for any purpose, and after voluminous experiments he discovered that in a certain hilly district of Japan existed a form of bamboo which, after a certain age of growth and seasoning, was just what he required, and that when he pared away the inner pithy fibres and the hard calcareous outside he found in the centre the most perfect vegetable fibre he had ever seen, and this is what he uses to-day, although specially commissioned men have been exploring for years past and are now searching to discover a still better substance. By referring to the valuable and careful tests conducted under the auspices of the Franklin Institute at the Philadelphia Electrical Exposition, you will observe not only the remarkable economy of the Edison lamps, but the mechanical strength of the filament. The results of those life tests showed Edison's lamp to-day to be far ahead of the other lamps tested at that time in point of efficiency or economy, and fully as long lived.

While Mr. Edison has confined his attention more particularly to his two and three wire systems of incandescent lighting, he has also spent a large amount of time elaborating various other systems of distribution and methods of regulation and control. Next to the above, the two principal ones are his "municipal system" and his "system of direct conversion." In the former he employs low resistance, incandescent lamps in series requiring a high electromotive force and constant potential.

This system has solved the economical distribution of incandescent light over large areas for street lighting purposes. The flexibility of the system allows of the employment of a large number of circuits run from one machine, and circuits of ten miles in length may be operated with a No. 12 wire B. W. G. with but 15 per cent. loss. In practice each circuit carries 1,000 candles of light, which may be divided into lamps of various candle power to suit the localities.

In Fig. 14 may be seen the general arrangement of the dynamos, station apparatus and lamp circuits, together with the standard hood and lamp as employed to-day. The other system of direct transformation referred to is covered by patents taken by him in 1883. By this system direct currents may be converted from high to low potential and *vice versa*. This system is destined to meet with an extensive application in conjunction with Edison's low-tension system.

Few patents of Mr. Edison's are of greater scope and value than those covering his methods of distributing

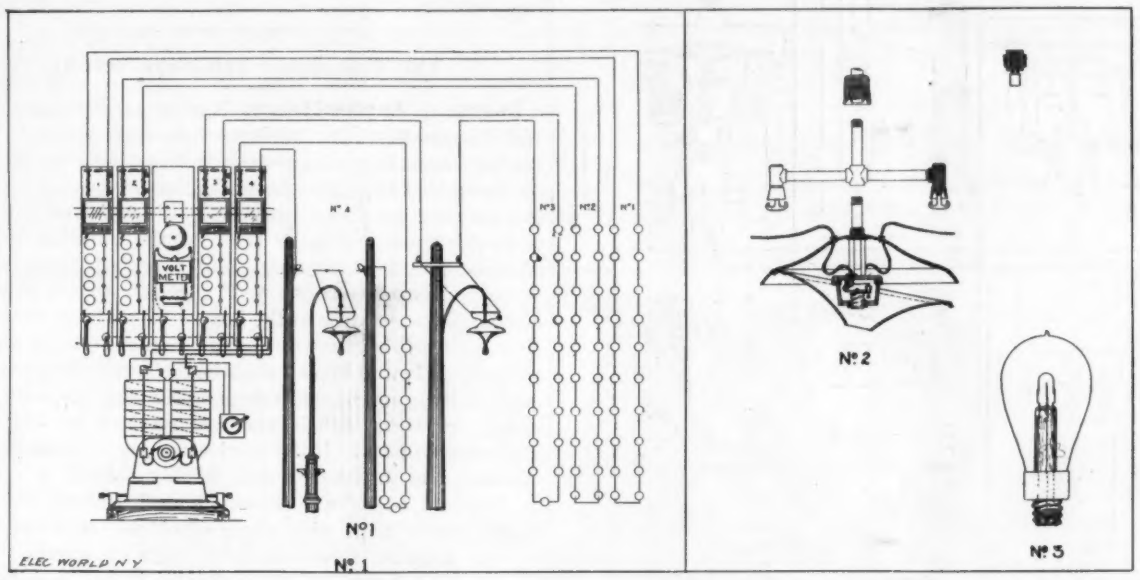
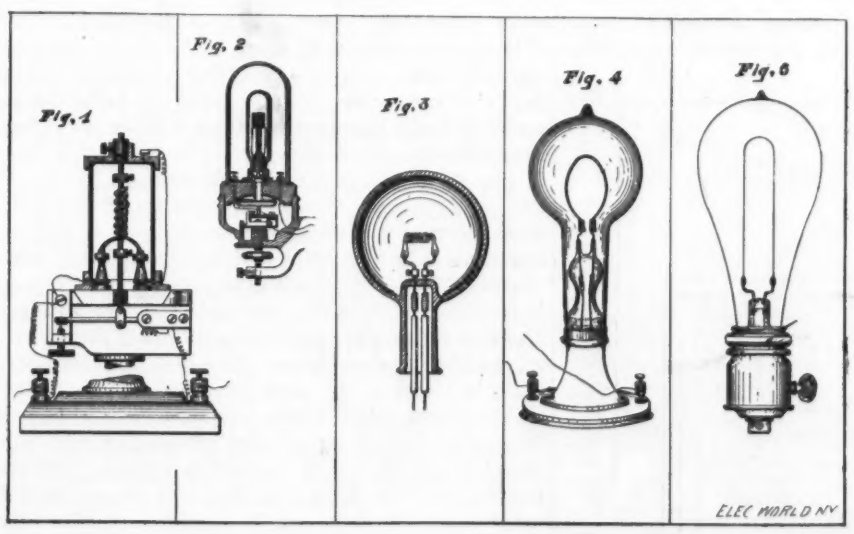
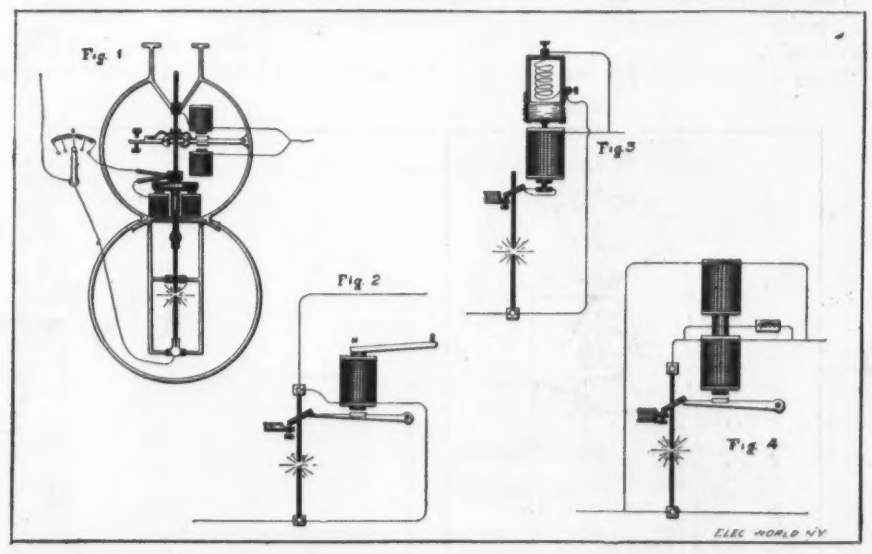


FIG. 14.—THE EDISON MUNICIPAL INCANDESCENT SYSTEM.





FIGS. 13 AND 15.—EDISON'S INCANDESCENT AND ARC LAMPS.

electricity for light and other purposes. The Edison electric lighting industries in the United States alone have installed 650 miles of underground wires, equivalent to 217 miles of Edison tubing.

ARC LIGHTING.

Mr. Edison has devoted himself almost exclusively to the incandescent system of lighting, but he has nevertheless done some work in arc lighting, as evinced by his patents shown in Fig. 15. Diagram 1, which is the most important type, represents a lamp carrying a motor acting independently of the feeding mechanism, for rotating the upper carbon, thus producing an absolutely steady arc.

EDISON METERS.

An enormous amount of research and experiment has been expended by Mr. Edison to secure a means of measurement of electricity in buildings supplied from a central station. These experiments cover extensively applications of clockwork, mechanism, electro-magnets, solenoids, springs, heat electrolysis, electro-deposition, etc. Some of these highly ingenious devices are shown in Fig. 16. The type at present in use, which is the same in principle as that adopted some eight years, is shown in Fig. 17, which shows exteriors and interiors. It consists primarily of a zinc-depositing cell, connected around a German silver shunt, and having a temperature-compensating coil of copper in series with it; $\frac{1}{99}$ part of the current passing into a house is shunted through the cell, which by the simple process of plating zinc upon one plate from the other gives an accurate record of the work done or the current used.

Faraday's law of electrolysis is absolute, and gives us in the Edison meter a means of measurement at once simple, economical and accurate, as long commercial usage can testify.

Those desiring full information upon this subject, I would refer to Mr. W. J. Jenks' admirable paper on the Edison meter, read before the Institute of Electrical Engineers, New York, Dec. 18, 1888, and reproduced in The Electrical World, and other papers on Jan. 5, 1889.

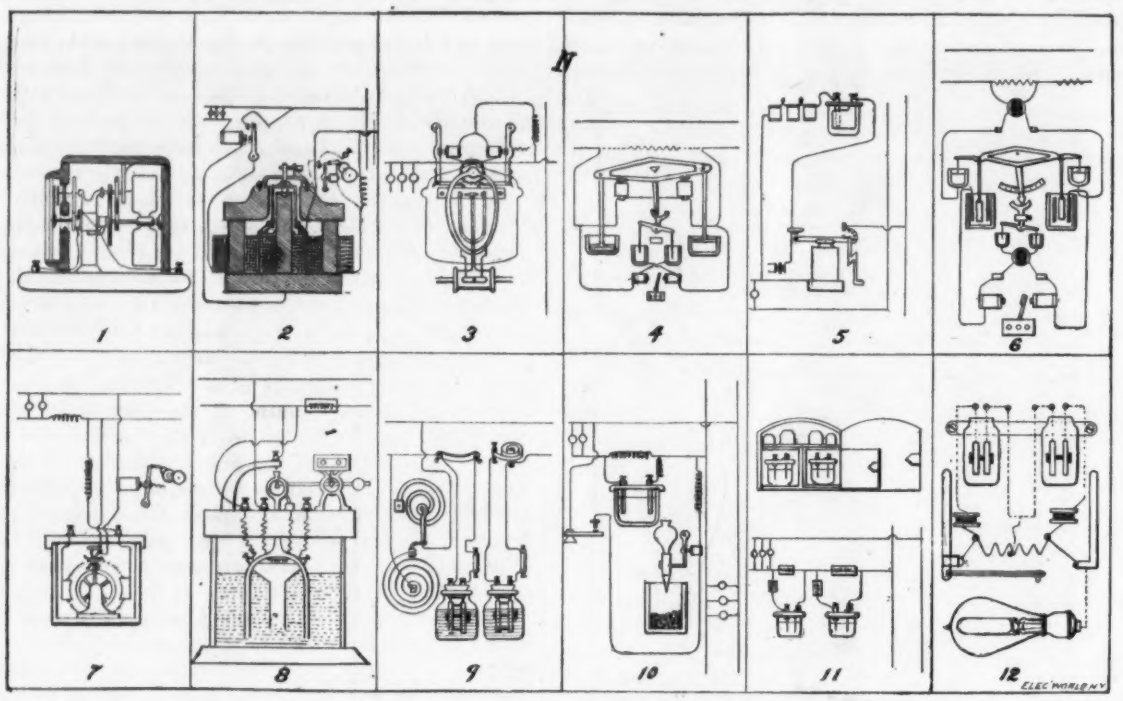


FIG. 16.—TYPES OF EDISON METERS.

NEW WEIGHT VOLTMETER.

Edison's new weight voltmeter is shown in Fig. 18, diagram 1. It consists of a delicately hung scale beam, from one end of which hangs a small solenoid in series with a larger one into which it dips. At the other end of the beam depends a brass cup filled with shot, enabling an adjustment of the instrument to any electromotive force, by balancing the induction of the one solenoid upon the other, by dropping shot into the cup. As in the case of the electro-dynamometer this instrument is not affected by the earth magnetism and is absolutely accurate in any part of the globe.

Mr. Edison has also devised a registering electromotive force indicator, the indications of the instrument, as shown by the position of a galvanometer needle, being recorded upon a sheet of paper revolved by clockwork.

At stated intervals a light arm placed at right angles to and above the needle descends, causing the needle to complete the circuit through one of the commutator plates underneath, thus registering the E. M. F. at that time by the position of the needle.

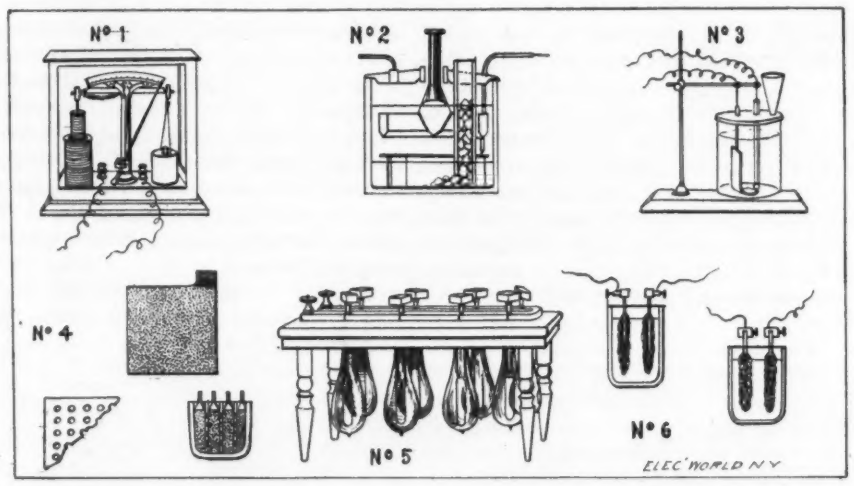


FIG. 18.—EDISON WEIGHT VOLTMETER, VOLTAMETER, ETC.

SONOROUS VOLTAMETER.

This instrument, shown in Diagram 3, Fig. 18, consists of two electrodes of platinum immersed in water. The negative is in form of a strip, and the positive a wire sealed in a tube of glass ground flat at the bottom; a bubble of hydrogen forming at the end of the tube is finally detached, rises to the surface, where it explodes, the closed chamber and funnel on top making the sound more sonorous.

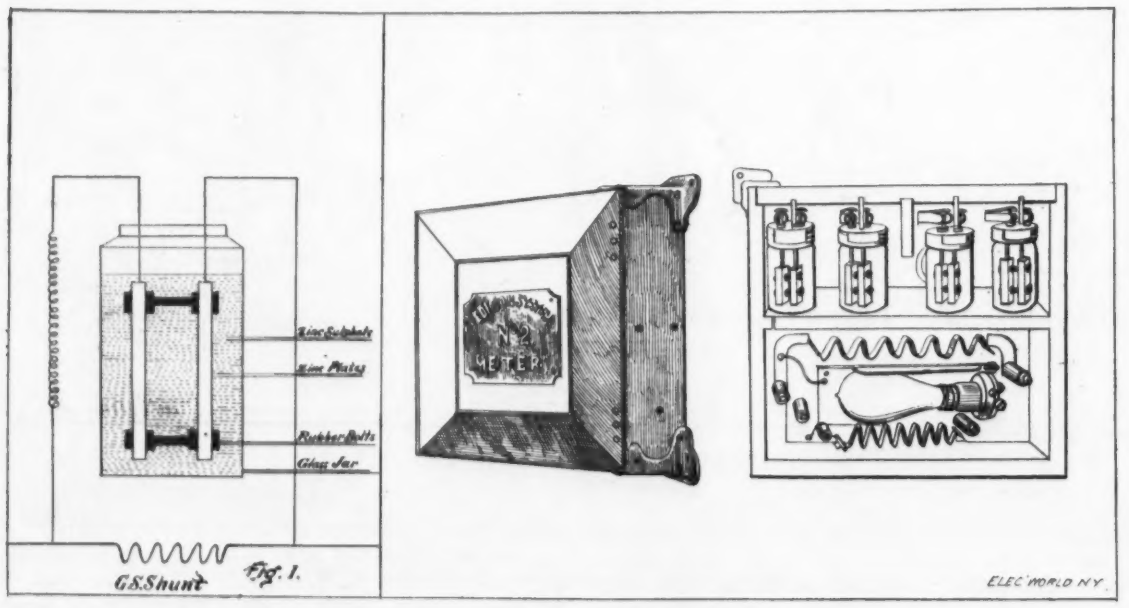


FIG. 17.—STANDARD EDISON METER.

An Electro-Medical Vaporizer.

An ingenious apparatus has been devised by a Dr. Telschow for the purpose of vaporizing solid medicaments, and it has already rendered great service in connection with throat complaints. The apparatus consists of an india-rubber syringe, traversed by a piece of platinum wire. This wire is covered with the powder medicament, and a strong current of electricity is sent through it. The wire becoming incandescent, the powder is vaporized and is carried by the current of hot air in the required direction.

The Wanamaker Telegraph Scheme.

Discussing the postal telegraph scheme of Postmaster-General Wanamaker, a special dispatch from Washington of September 4 says: It is admitted by officials at the Post-office Department that they have been working on some of the legal and practical questions connected with government control of the telegraph, yet many sides of the question seem to have escaped their attention. The postmaster-general will probably hesitate to recommend a strictly government telegraph system, because of the large deficit which would appear if the service were extended as generally as the postal service. It is well known that the telegraph service in England under government management has shown a constantly increasing deficit, and has resulted in very little difference in rates. If the service cannot be economically conducted in so compact and thickly settled a country as England, with a permanent and trained force, it would seem that the experiment of state socialism in this country would be even more disastrous. There would be a constant struggle between the political interests which demanded an extension of the service to unprofitable localities and the glaring deficit which such a policy would create. There would be a good many practical difficulties with the plan credited to the Postmaster-General of having the government enter into partnership with the telegraph companies for the delivery of messages through the post-office. Of course, there will be no responsibility on the part of the government for its share in handling the messages any more than there is in handling registered letters and paying money orders. If a dispatch miscarries through the negligence of a letter carrier, there will be no redress for the sender or receiver except that he may have the satisfaction of seeing the carrier discharged. So long as the telegraph company has charge of the transmission of messages it can be held responsible for errors, but delays, even occurring in its own office, will be hard to locate when the responsibility is shared with the government. The opinion is expressed by those familiar with the free delivery service that the carriers would be of little use except in delivering night messages, which are subject to delay and which could be taken on the first morning delivery. Messages which demand immediate attention would have to be handled by the special delivery messengers who now deliver letters with the 10-cent stamp affixed. It might be possible to divide dispatches into two classes at different rates—one to be delivered by carriers and the other by special messengers. It is generally believed, however, that Mr. Wanamaker's new scheme of paternalism would prove very clumsy in its operation and lead to endless confusion and litigation. The civil service reformers, whether advocates of centralization or not, will be certain to oppose any proposition to increase the number of offices under the control of the Postmaster-General so long as they are distributed according to the present plan. Some of the advocates of a postal telegraph argue that the operating service would be so technical in its character that the places would not become the spoil of party politics. This might prove to be the case when the service had been for a number of years under government control and there was but one employer to apply to, but for some time to come there would probably be operators enough of both parties clamoring for place to furnish the motive for frequent change. The public nature of telegraphic messages, unless written in cipher, would also place a dangerous power in the hands of the dominant party if the service were prostituted to partisan ends.

A New Method of Driving Dynamos by Friction Belting.

We illustrate this week an ingenious device designed and placed upon the market by the Evans Friction Cone Company, of Boston, for driving dynamos or other machinery direct, by means of a friction belt.

Fig. 1 represents a 100 h. p. high-speed engine, driving either two or four dynamos, all the power being transmitted through the friction belt *A*, which hangs loosely on the pulley *B*. This arrangement, it is claimed, has many advantages over other methods of power transmission.

The first cost of the belt is greatly reduced, as in ordinary stations, it would, in all probability, require 200 feet of belting to drive four dynamos by the usual method, but with the Evans friction belt only 3½ feet for each dynamo are required. In building electric light plants, where land or floor space is valuable, this manner of transmitting power effects considerable saving. In driving dynamos or any other kind of machinery, the ease with which the dynamo or machine can be connected or disconnected with the engine is of the utmost importance. The old-fashioned device of a fast and loose pulley is replaced by one four times as powerful, it is claimed, much more simple and quick-acting, and one that gives the engineer absolute control over the movements of his machinery by enabling him to stop or start instantly. An engine and water-wheel may be attached or detached quickly, and independent of one another. There have been many attempts to successfully transmit power by friction, but they have generally failed on account of the friction material being in rigid adhesion with the pulley. In the Evans system the friction belt, which is simply made of leather, hangs loosely on the dynamo pulley, and revolves around it.

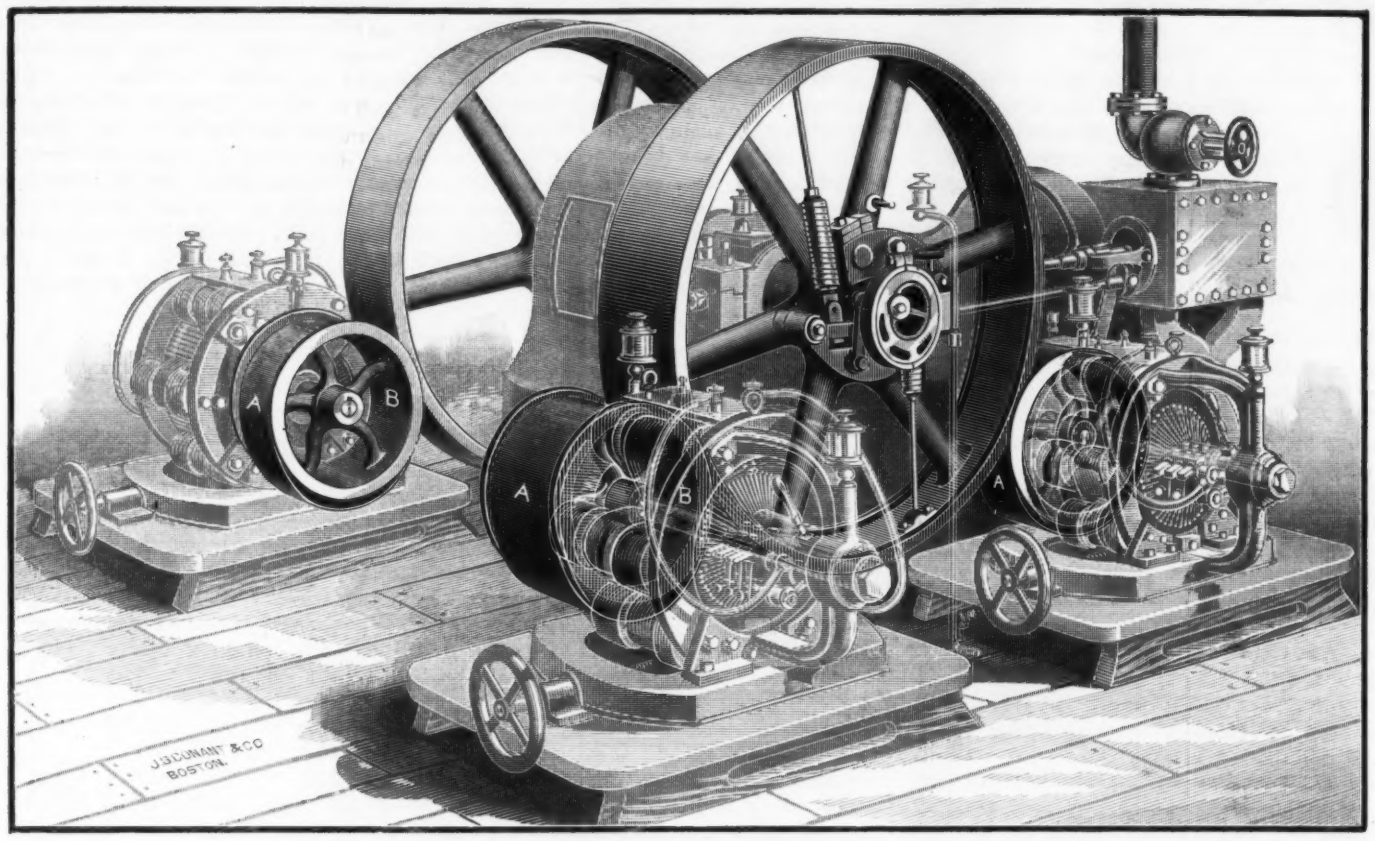


FIG. 1.—ENGINE WITH EVANS FRICTION BELT DRIVING FOUR DYNAMOS.

The dynamo is pushed forward on a sliding frame until the driving pulley of the engine presses against the belt, when the dynamo pulley at once begins to revolve easily and without any sudden start. The motion is absolutely noiseless and steady, and there is no slip whatever. It is said to be actual fact, as can be demonstrated by the experiment illustrated in Fig. 2 and described below, that more power can be got out of the same size of belt used on this friction system, than by the ordinary method of driving.

In the diagram, Fig. 2, is represented a machine constructed to show the difference between transmitting power by the Evans friction belt and the ordinary straight-faced or cone pulleys, as to the capacity or efficiency of the belts and the friction upon boxes, one belt compared with another in the same operation. *A* and *B* are two pulleys, 4-inch face; *E* is an open straight belt, 3 inches wide; *F* is an Evans friction belt, 1½ inches wide, guided by an idler *C*; box *G* is bolted to the frame that all the pulleys are mounted on; box *H* is free to slide to and from box *G*, according to the strain of belt *E* and the resistance of the friction belt *F*, which is all the pressure there is on the friction belt *F* and box *G*.

By putting a brake on pulley *K*, which is on the shaft of pulley *B*, while running at any speed, belt *F* holds pulley *A* dead still, but belt *E* slips, and pulley *D*, being the driver, continues to run.

In this test the difference between the one and a half inch belt on straight face and cone-shaped pulleys was so little that it would not be detected.

This shows conclusively that the friction belt *F* is more than twice as efficient with the same pressure on the bearings, because the friction belt *F* is but half the width of the open belt *E*. The above test was a public one, and made in the presence of experts.

We have recently seen a dynamo at the Water Works, Boston, driven by this method, and the action is perfect. The engineer in charge claims it to be a complete success, there being absolutely no variation in voltage of the lamps.

This new device appears to meet a long-felt want for a reliable friction gear, and will, we feel sure, be employed very generally.

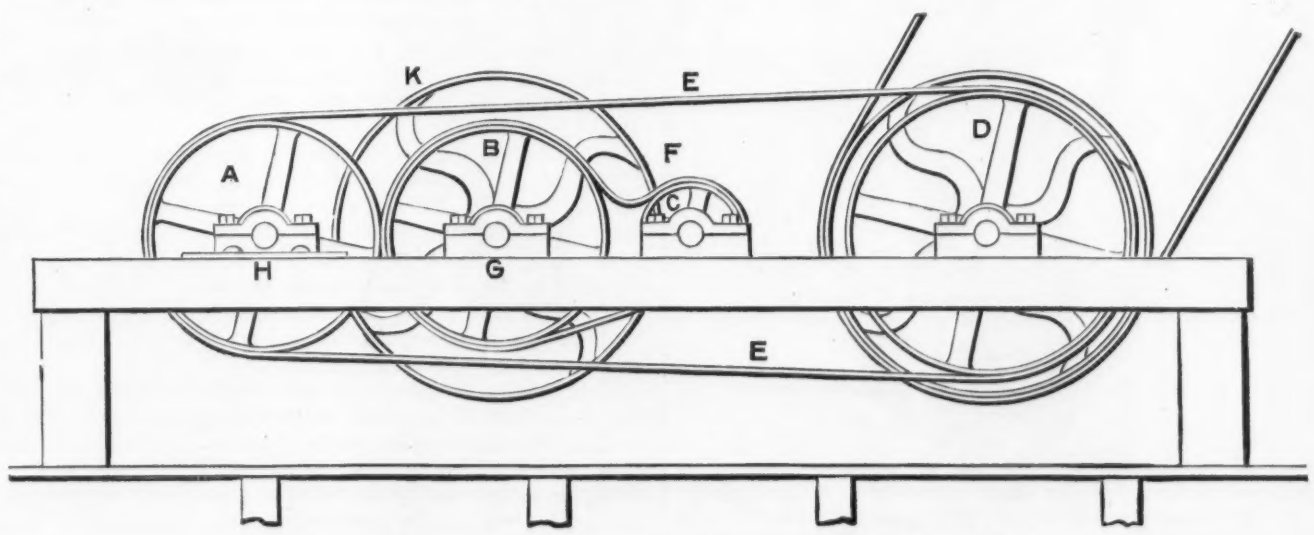


FIG. 2.—TESTING TRANSMISSION BY EVANS FRICTION BELT.

Lighting the Washington Navy Yard.

The specifications which were drawn up by Commander Bradford, the Naval Inspector of Electric Lighting, for the one hundred and twenty 2,000 c. p. arc light plant to be installed at the Navy Yard, Washington, are probably the most complete specifications of the kind ever issued. They call for the very best and most expensive apparatus, engines, line wire, iron poles and workmanship. Voltmeters, registering from 50 to 2,000 volts, are included, as are also ampere meters, rheostat with bridge, and galvanometer, and tachometers, all of the latest and most improved and expensive patterns. The switchboard is to be of slate, and to be furnished with connections necessary to place any one of six dynamos on any one or more of six circuits, or to cut out any circuit. In addition to this, the connections are to be so protected as to render it impossible for an attendant to make an accidental contact with any conducting metal. All switches and cut-outs are to be insulated, so that it will be impossible to receive a shock from them. The lamp posts are to be of iron tubing, tapered in length from the ground up, and similar in general design to those in the city of Boston. Metallic contact is to be broken at two sections in the length of the pole by insulating joints. The belting and all appurtenances of the plant are to be of the latest and most approved pattern.

After a severe competition the contract was awarded to the Brush Electric Company, of Cleveland, O., who, after they have installed the plant in accordance with the specifications and under the approval of the Government Inspector, will no doubt turn over to the government one of the most perfect and modern arc light plants of the day.

Method of Taking Photographs of Lightning Flashes.

At a recent meeting of the English Photographic Club, Mr. W. Marriott, fellow of the Royal Meteorological Society, was requested to draw up instructions for taking photographs of lightning. The following brief rules are offered: 1. The camera should be focused during the daytime to some distant object and a mark made on the camera, so that at night it may be quickly adjusted when a storm is approaching. 2 A rapid rectilinear lens, with full aperture, should be used. 3. The camera should be directed to the part of the sky where the lightning is most likely to occur. 4. The camera should be firmly screwed to the tripod stand. 5. It may be necessary to tilt the camera slightly, especially if the lightning be mostly in the zenith. If this be done, a note should be made of the amount of inclination. 6. A portion of landscape, roof, chimney-pot, etc., should, if possible, be included on the plate. If this cannot be done, the top of the plate should be carefully marked before it is removed from the dark slide. 7. The exact time of each flash, the interval in seconds between the lightning and the thunder, and the point of the compass in which the flash appeared, should all be carefully recorded. 8. It is desirable that there should be only one flash upon each plate. 9. If circumstances permit, two cameras should be used—one fixed on the tripod stand and the other held in the hand—and two separate photographs obtained of the same flash. 10. It would be very interesting and valuable if two or more photographers could obtain pictures of the same flash from different points of view. By this means it might be possible to determine accurately the distance of the flash, and also its movements in the atmosphere.

The Small-Goodson Electro-Matrix Machine.

S. S. Small and George A. Goodson, the Minneapolis inventors, who brought out an electric device for indenting type characters upon prepared matrix paper some time ago, have been building a number of the machines at Springfield, Mass., and have recently given an exhibition of its work. The machine is thus described by the *Springfield Republican:* The new matrix machine is only 30 inches long and 6 inches wide. It is worked on a table similar to those used for type-writing machines. The power for driving the dies into the matrix can be furnished from an ordinary incandescent electric light wire, a current of 110 volts being sufficient. The operator works a key, which has a swinging and sliding motion similar to that of a key on a single-keyed type writer. This has a platinum point which fits into counter-sunk holes on the index plate. The plate has 91 such holes for letters and characters, the most important ones being placed in a very short radius. The key works from a pivot, and on the opposite end from the operator are type-faced steel dies corresponding to the letter on the index board. When the key is inserted in the index plate it automatically closes a combination of circuits. These operate a differential electric feed that projects the matrix material a space, according to the letter touched. Almost simultaneously with this movement, an

electric solenoid above straightens a toggle lever, forcing down a punch the proper distance into the matrix cardboard. The lever is so delicately adjusted that the type-faced punch goes down just the right distance. A lever worked by hand pulls the matrix carriage back when the end of a line is reached. Six keys for the six different spaces are also operated apart from the key and index board.

The chief "out" about this system seems to be that especially prepared copy is necessary in order to use the unit system of justifying the lines to the column width. The copy has first to be prepared on a type-writter, which has an attachment registering the spaces. The unit of space is one-sixth of an em. Supposing the column width to be 150 spaces, and the type-written line closed at 148

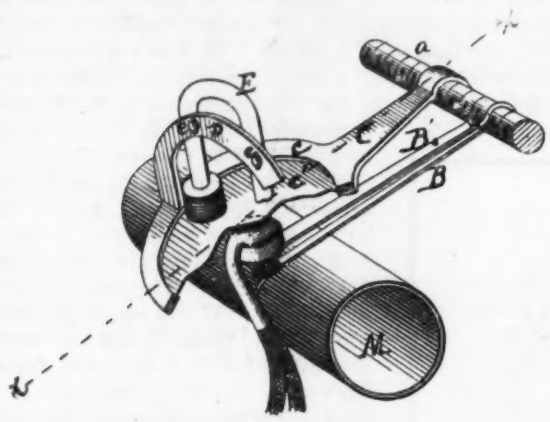
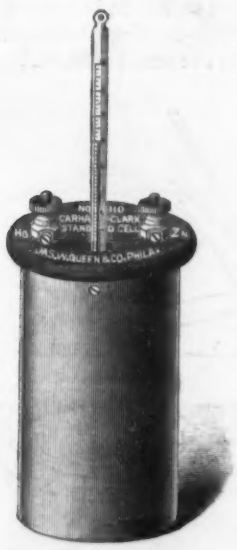


Fig 2.—The Wheless Telegraphophone.

spaces, the operator then indicates by the figure 2 the number of spaces needed to justify the line, and these operations are said to be easy to follow when one becomes expert with the machine. This prepared copy is treated as proof, and carefully corrected for the matrix machine. An average of 25 words to the minute is claimed as a conservative estimate of the speed on the matrix machine, and one space registering type-writer can prepare copy for two machines.

The Clark-Carhart Standard Cell.

Last week we gave an abstract of Prof. H. S. Carhart's paper, read before the American Association for the Advancement of Science, on the modification of the Clark cell that he has devised, and we supplemented that by some details of the cell now being manufactured by Jas. W. Queen & Co., of Philadelphia, and called by them the Clark-Carhart cell. We now show an engraving of the cell on this page. The cell is mounted in handsomely finished brass cases, 3¾ inches long and 2⅜ inches in diameter, with an engraved hard rubber top, on which, as will be seen, appears the number of the cell corresponding to the nnmber on the certificate furnished by Professor Carhart as to its E. M. F., temperature coefficient, etc. In the rubber is a hole for the insertion of a thermometer to ascertain the temperature inside the cell. Batteries of these



The Clark-Carhart Standard Cell.

cells to any number will be furnished thus mounted up, or in other shape. As a precaution against short-circuiting, Queen & Co., mount a graphite resistance of about 20,000 ohms in circuit with the cell and inside the case inclosing it.

The Wheless Telegraphophone.

This instrument, the invention of Mr. M. Wheless, of Nashville, Tenn., is illustrated in Figs. 1 and 2, and is an improved method whereby the indentations upon the cylinder of a graphophone can be reproduced upon another cylinder, and at the same time the vocal sounds represented by these indentations are rendered audible.

Two similar graphophones are placed in circuit, which may be either primary or induction, the latter being preferable, so that the vibrations produced at one graphophone by the recording stylus moving over the cylinder shall be taken up by the reproducing stylus and be reproduced at the other graphophone, and, making identical indentations there, at the same time be transferred into sound waves.

In the use of the graphophone as it is now operated, sound waves are converted into indentations upon the surface of a cylinder and can be reproduced at pleasure, as is well known.

In telephoning as now practiced a serious defect in the system is, that when a subscriber is called up and there is no response, the caller cannot use the instrument and must wait another opportunity, and by combining the principle involved in these two systems it is possible by the use of this invention to so connect up two graphophones on a telephone circuit that not only will the message be audibly received at the receiver, but it will also be reproduced upon a graphophone there. In case of the absence of the subscriber, he can on his return obtain the message; also, this becomes a record which can be filed away for future use.

To the threaded bar of the graphophone, *a* Fig. 2, are hinged two metallic arms, *B B'* one above the other—insulated from the bar and each other. The lower arm has at its end on the under side a stylus, and on top a carbon contact.

To the under side of the end of the upper bar is a metallic point which rests upon the carbon contact, and on its upper side is another metallic point resting against a diaphragm carried by this arm, and made of gold-beater's skin. To the diaphragm is secured a pipe with an ear piece.

There is also fastened to the threaded bar a stem *c* carrying an annulus and metal diaphragm *c'*, and across this annulus is an arch which is secured thereto. Supported vertically at

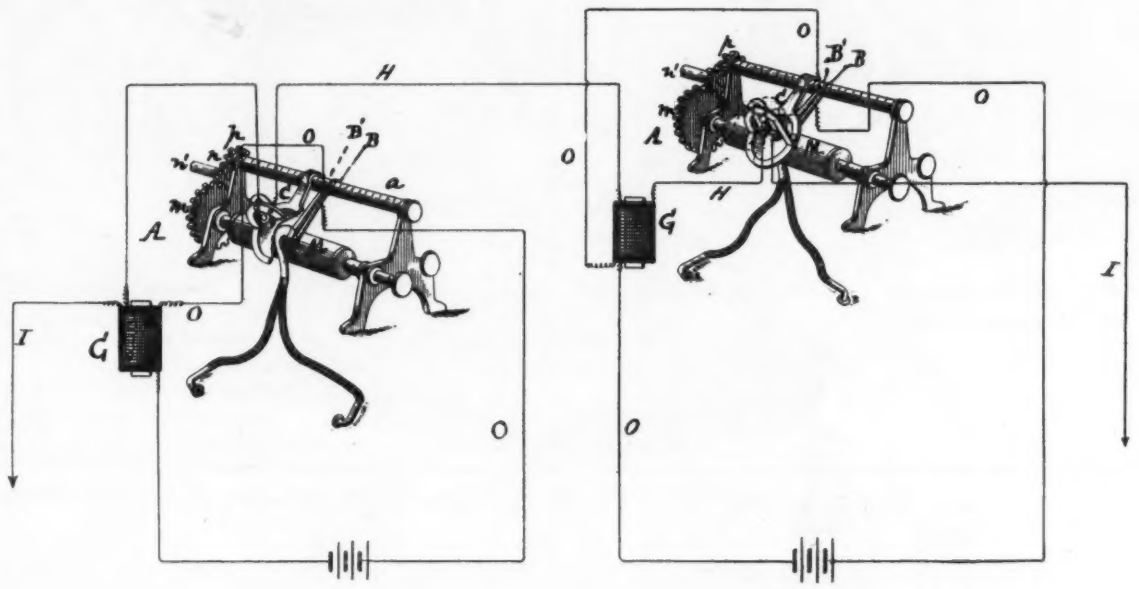


FIG 1.—CIRCUIT FOR WHELESS TELEGRAPHOPHONE.

one side of the arch is an electro-magnet capable of adjustment.

To the under side of the metal diaphragm is fastened a stylus. The annulus and diaphragm is considerably larger than the diaphragm of gold-beater's skin, and covers it This relation brings the two stylii in almost the same plane and over the cylinder of the graphophone. Upon the metal diaphragm is placed the usual mouthpiece, not shown in the figures.

At each graphophone is shown, Fig. 1, a closed primary circuit, this circuit being kept open when not in use, by means of a switch. The two arms are in the circuit, which is closed at the metallic and carbon contacts. The primary circuits are provided with the inductive coils, which are connected by the usual line wire and to earth, the coils of the magnets being in the inductive circuit. It is evident that the two graphophones must be kept in motion while the message is being transmitted.

To operate the instrument the two graphophones are set in motion, the primary circuit at the sending station being closed and the stylii resting on the cylinders. The message is spoken through the mouth-piece against the diaphragm of the transmitter, and by means of the recording stylus the usual indentations are impressed upon the sending cylinder. As these indentations pass away from the first stylus they come in contact with the reproducing stylus. This second stylus takes up the vibrations and transmits them to the carbon point, where the local circuit is closed and the induction currents are sent out to the line equal in variation and tension to the primary disturbance. These currents passing over the line disturb the magnet at the receiving station, thereby disturbing the diaphragm actuated by the magnet as well as the stylus, which is attached to the under side of it, and the cylinder is indented with indentations equal to the disturbance of the diaphragm. These indentations made upon the receiving cylinder are identical with those made upon the sending cylinder, one being a duplicate of the other. As the indentations upon the receiving cylinder pass away from the stylus attached to the metal diaphragm, they pass under the second stylus, which disturbs the diaphragm of gold-beater's skin, and this disturbance makes the wave sounds, which are articulate and audible.

Ocular Demonstration of Telephone Vibrations.

At a recent meeting of the Berlin Physical Society, Berlin, Dr. Frohlich made a communication in connection with the objective demonstration of the vibrations of a telephone disc. In his earlier experiments he employed manometric flames, and endeavored to photograph their movements with the help of a rotating mirror; now, however, he attaches a small mirror to the iron plate of the telephone, and from this the light of an electric lamp is reflected on to a polygonal rotating mirror, from which it falls upon a screen. The vibrations of the plate were thus made visible on the screen, and since each side of the polygonal mirror cast its own image, when the mirror was rotated the curves were seen moving over the screen. The more rapidly the mirror was rotated the slower did the curves move over the screen, and when the rotation was as rapid as the vibration of the plate, the curves became stationary, and could thus be easily observed and drawn. These luminious curves could also be photographed. The speaker had employed this method in a series of researches on certain electrical phenomena which might influence the efficiency of the telephone. Thus the action of alternating currents, of self-induction, of the rise and fall of the current on making and breaking, of the induction of electro-magnets, and of other conditions, were studied by means of the altered mode of vibration of the telephone plate. He had further obtained a graphic record of the vibrations of the telephone piate when vowels and consonants are sung and spoken into it. Many other problems may, by the above method, be brought nearer to their solution.

The Electric Light Situation at Allegheny City, Pa.

The Gas Committee of the Allegheny City Council opened the bids for city lighting last week on Thursday, and after some discussion referred them to a sub-committee for tabulation. The Westinghouse Electric Company, the Brush Electric Company, the Brilliant Electric Light Company, the Jenney Electric Light Company, of Indianapolis, and the Fort Wayne Jenney Electric Company, of Fort Wayne, Ind , were the bidders. There were two plans of bidding proposed at the opening of the meeting: The first to establish the plant on a rental of five years, and the second to sell the plant to the city outright. After some discussion it was decided to consider the bids of such companies only that were willing to sell the plant to the city outright. On this plan the bids of the Fort Wayne Jenney, the Westinghouse Electric Company and the Brush Electric Company were handed in. The Fort Wayne Jenney Light Company's bid for erecting the plant and selling it outright to the city was $140,195. This included the cost of running the plant for the first six months on trial, which was estimated at about $11,000. The Brush Electric Company, of Cleveland, bid for the sale of a plant. Six prices were submitted on different specifications as different makes of engines, etc. Their offers ranged from $156,101.83 to $166,856.83. If plain poles were accepted instead of octagon their bid would be $2,500 less.

The Westinghouse Electric Company for rental of their lights offered 20 per cent. discount from their regular price list. They would sell a plant to the city for $141,158, including $9,000 for the cost of running it for six months on trial.

This concluded the bids, and Mr. Kennedy moved that they be referred to a sub-committee of five and the chairman of the general committee, for tabulation, many figures having been given on various articles, the sub-committee to report in a week.

The "Arnold" Steam Friction Dynamo.

Our illustrations, Figs. 1 and 2, show a new frictional plant designed especially for marine purposes, and from the small amount of floor space occupied, one that is particularly adapted for use on steamboats, men-of-war, steam tugs, steam yachts, etc.

The plant shown in the cuts is capable of generating 45 ampères at a pressure of 80 volts. It is installed aboard the steam yacht "Restless," owned by Col. Wm. M. Singerly, proprietor of the Philadelphia *Record*, and is now chartered by Postmaster-General Wanamaker. who has entertained President Harrison on board. It takes the place of a smaller one, that was installed some time ago, but since the yacht has been lengthened it was found necessary to increase the capacity of the dynamo.

Fig. 2 shows a front view of the engine, and Fig. 1 shows the dynamo side of the plant. It also illustrates the manner of supporting the dynamo and the means for adjusting the friction.

As these illustrations show the design of all the plants, it is only necessary to describe one in general. The engine is of the double-cylinder, single-acting type, and has all its working parts enclosed and operating in an admixture of oil and water. The cranks are of steel, and are of large size both in diameter and length. The main bearings are two and one-half times the diameter of the shaft in length. The cylinders being directly over the shaft, the arrangement allows the engine to operate in either direction as desired.

The valve is of the balanced rocking type, and is the length of the width of the two cylinders, which gives it very long wearing surfaces. The chest for the valve forms the cylinder covers, and being so close to them gives the advantage of having very wide ports, at the same time making them shallow, which saves the waste of steam due to long passages.

The fly-wheel is of cast-iron, and is turned true, and within it is contained the governor, which consists of only four parts. The action of this governor is to change the throw of the valve through the eccentric, and its direct connection to the valve makes it very sensitive to any changes in load.

Lubrication is accomplished by carrying in the crank case a body of oil in which is placed a small quantity of West Virginia oil, into which the cranks dip at every revolution, not only oiling themselves but throwing the lubricant on to every part of the working surfaces. As this oil is not allowed to escape, it is used over and over again, and being enclosed, the waste oil and water are not thrown around. The eccentric and governor are the only parts that are not constantly flooded in oil, but only a small amount is required on account of the perfect balance of the valve.

On the periphery of the fly-wheel is secured a paper rim which can be replaced in a very short time when worn out. One that has been in operation for over two years has not shown the least sign of wear, although it is covered with oil that has been allowed to accumulate on its surface. At the same time the oil has not impaired its friction qualities; in fact, oil, water or steam seem to have no deleterious effects on it, but hot water will soften it in time.

These friction fillers are made from discs of strawboard, and are then subjected to powerful hydraulic pressure. They contain silicon in a fine state, and will always keep rough instead of glazing, as is the case where the paper is applied in layers.

The dynamo is of the Siemens drum type, with an armature 5 inches in diameter and 10 inches long. The fields are upright, and terminate in pole pieces at the top. The shaft is supported in an X-shaped bearing at the pulley end and by an arm at the commutator end. These bearings have interchangeable bushings, which can be readily and easily replaced when worn. In fact, the whole plant is built on the interchangeable plan, and each and every part can be replaced when worn.

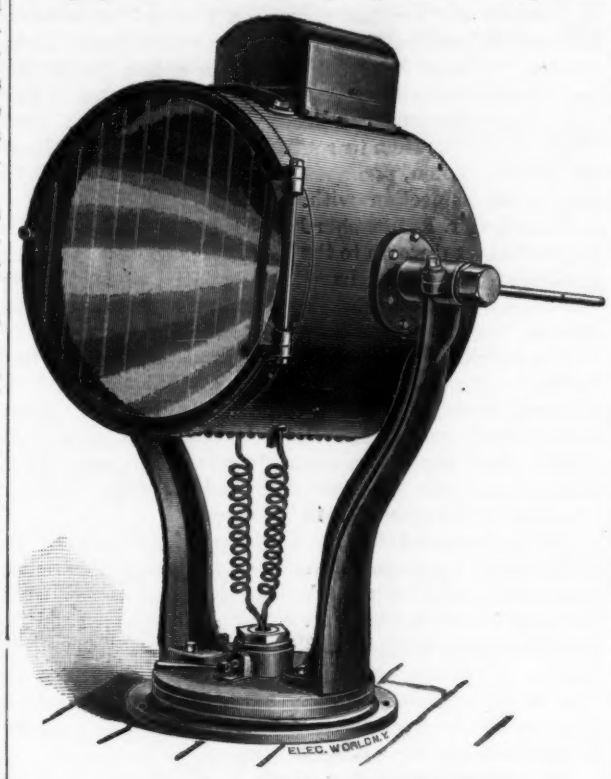


FIG. 3.—ARNOLD SEARCH LIGHT.

The dynamo is supported on an extension of the base by a rod running through the neutral field of it. This rod serves the double purpose of supporting the dynamo and at the same time allowing it to be brought up to the engine wheel by the operation of the nuts on the brass rod running from the side of the engine to a projection on the outside field. The pulley on the dynamo is made in the same manner as the engine wheel. The nuts that serve to hold the dynamo up to the engine can be sufficiently tightened by the fingers to apply the necessary friction.

In starting these plants, the outside nut is loosened (the inner one being used for the purpose of bringing the dynamo up to the same place every time), and the machine falls away from the engine and allows it to attain full speed before the dynamo is brought to bear on the engine wheel. On the other hand. the dynamo can be instantly stopped by turning this nut in case of damage, without the trouble of having to stop the engine.

An experiment to show the flexibility of this mode of driving is to put a full load on the dynamo and then short-circuit the terminals. The result is that there is an enormous load thrown on the machine for an instant and slows it down almost to a stop, in the meantime the engine going on and the wheels slipping enough to allow it to do so.

In the case of this experiment being tried with a belt, the result is in nearly every case to throw it off, and in direct coupling to do more serious damage.

The regulation of these plants is all that could be desired, and they will admit of any change in the load to be made without the handling of a single part.

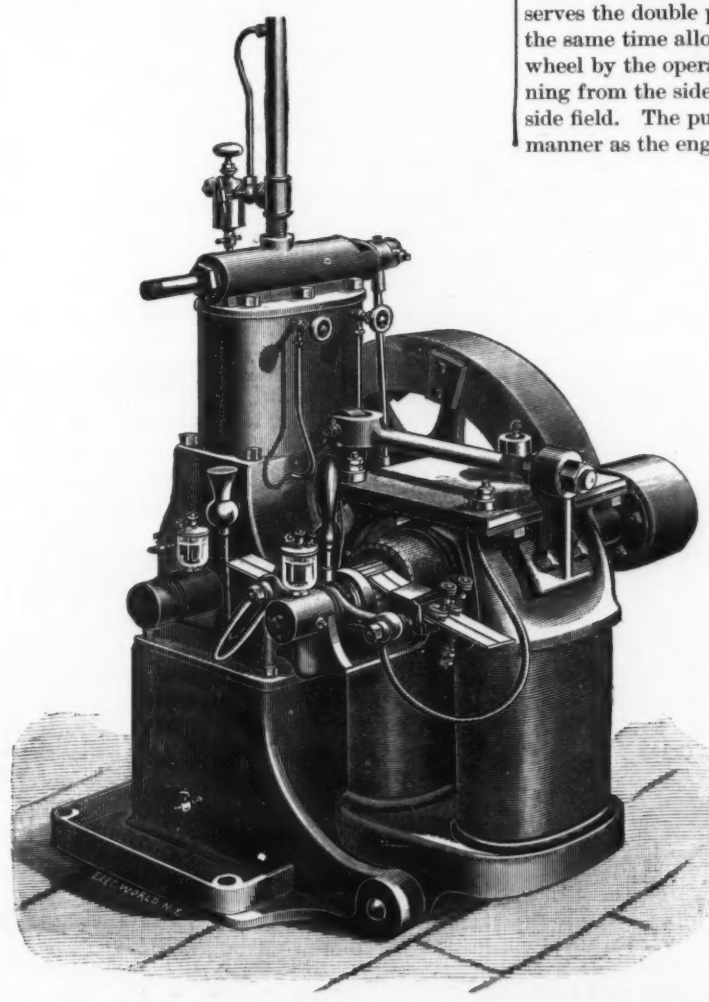
This size plant occupies a floor space of 31 inches by 31 inches and is 34 inches high and weighs 800 pounds. The fly wheel of this engine is 24 inches in diameter and it turns 625 revolutions per minute. The pulley on the dynamo is 7 inches and runs 2,143 revolutions, both having a face of 4 inches. The engine lost but 6 revolutions when fully loaded, with 80 pounds boiler pressure.

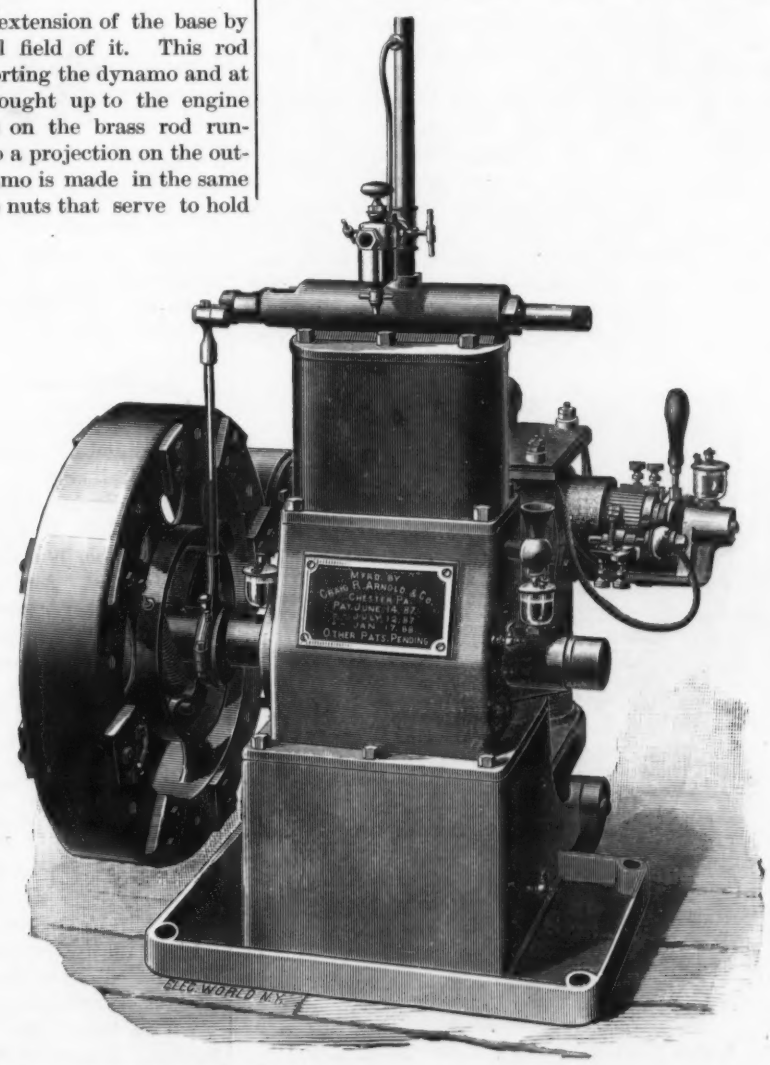
Fig. 3 illustrates a search light or holophote manufactured by the same firm. It is constructed in various sizes, according to the candle power required, from 15 inches diameter to 24 inches, being made very strong and durable, to withstand the hard usage of ship work, and is also supplied with a special automatic device by which it can be placed on any incandescent circuit, regardless of the voltage used.

This firm installed one on the steamer "Tangier," of the Eastern Shore Steamboat Company, of Baltimore, Md., on a Thomson-Houston dynamo running at 110 volts, and the regulator reduced the pressure from that to 50 volts, the current being 25 ampères. To show the fine working of the regulator, the carbons in the lamp were held together, forming a dead short circuit, and the current did not rise enough to melt the fuse wire.

This experiment was done without touching a single device. This light was so satisfactory that the owners gave an order to the same firm to fit out their other boat, the "Eastern Shore," in a similar manner.

All the above apparatus is manufactured under patents by Craig R. Arnold & Co., of Chester, Pa., after whom it is named.





FIGS. 1 AND 2.—THE ARNOLD STEAM FRICTION DYNAMO.

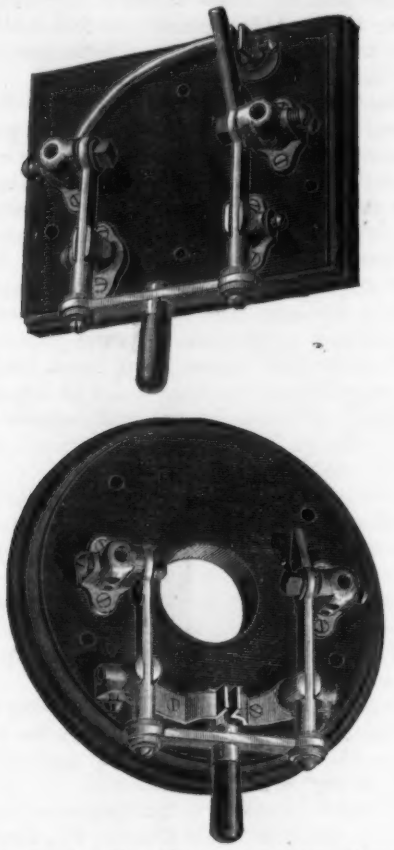
The Reception to Edison in Paris.

From an Occasional Correspondent.

PARIS, August 24, 1889.—In commenting on the events attending the French Exposition of 1889, the future writer will no doubt lay stress on the princely honors paid to Thomas Alva Edison, as one of the most marked features. Franklin and Humboldt in their day received the homage of Paris, but the welcome now being tendered to the American electrician is one probably never before received by a foreign visitor to France.

The departure from America of the "Great Magician" (as he is universally called) was heralded in the press, and thereafter daily notice of his approach to Havre given. A few days before the arrival of the steamer in France, *Figaro* in a leading article suggested that as the President of the Republic met royal personages at the railway station in Paris, it was but meet that he should proceed to Havre, and there welcome to France the sovereign of the industrial world. While *Figaro* is never to be taken *au sérieux*, the contrast

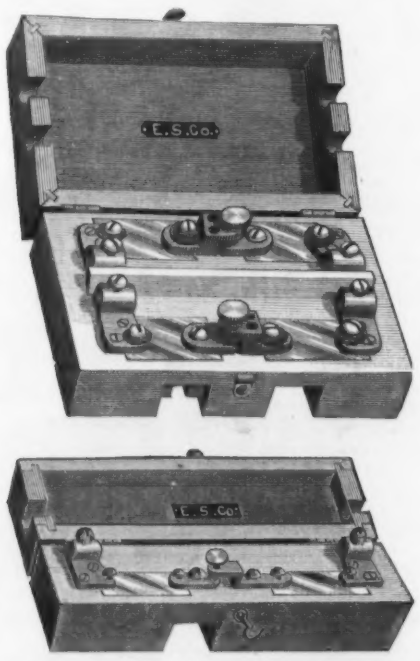
implied explains to some extent the warmth of the reception. The French are delighted that their great industrial exhibition has revived with added splendor the prestige so dear to them, which had become dimmed in the eyes of the



Figs. 1 and 2.—New Electric Light Switches.

monarchical Europe through the Republic; and as a striking representative of the spirit that has made the exposition a marvel, they are paying Edison the corresponding honors. In addition, the character of the inventions of Edison has a distinctive charm for the imaginative nature of the marvel-loving French, and through this and the enormous importance given to his exhibits in the exposition by the space allotted, his name has become better known to the public than perhaps that of any French scientist, Pasteur excepted.

Although interviewing has not yet become altogether acclimated in France, the visitor was met at the wharf by a corps of press representatives, and since then the greatest card for a Parisian journal is an interview with the great magician. To judge from some of the questions asked, the name of magician has been accepted in a literal sense, and, indeed, the popular conception in France seems to be that everything electrical has been evolved from this one mind. One interviewer asked if it was true that he had completed an invention by means of which a Frenchman in New York



Figs. 4 and 5.—New Extra Test "Fuse Box."

could talk to his wife in Paris, and at the same time see her features, and in general the press (from which my information has been derived) seems to think there is no limit to the marvelous extent of the great inventor's powers. The daily and most trivial movements are chronicled every morning and evening in the column devoted, after monarchical usage, to the movements of high government officials and royal personages, and the slightest event becomes a subject for an article. One writer, having read of Mr. Edison's habit of meditatively gazing for long periods into the sea during his voyage to Europe, devotes a column and a half to guessing what his thoughts were, and wondering if a look of sadness that was noted were not due to disappointment that he could think of no method of taming and utilizing the mighty forces of the ocean. Another devotes the same space to giving what he thinks were probably the impressions received on the Eiffel tower; and, to take advantage of the great popularity, a publisher has announced a life of the inventor in preparation.

Le Temps, the great journal of France, in a carefully considered article on the hero of the hour from a scientific standpoint, takes a view materially different from the popular one, and concludes that "while Mr. Edison remains none the less a man of real originality, who is an honor to his country and who has exerted a positive influence on mechanical progress during the last twenty years," nevertheless, "with all due credit to his inventive genius, it is yet permissible to think that his greatest art is that of coining money through the collective work of others." While there cannot be, from its source, any doubt as to the sincerity of this opinion, perhaps the plainness of its expression has some connection with a similar free expression of opinion by Mr. Edison shortly after his arrival, in regard to the little real worth to the world, of savants, the recollection of which must have subsequently, when féted by the most eminent savants, been an embarrasment to the author.

The government and the scientific societies have not been behind the press in their welcomes. Shortly after Mr. Edison's arrival he was presented to President Carnot. Tendered the use of the President's box for a representation at the Grand Opera House, it was, when occupied by him, draped with American flags, and the orchestra played the American national air in his honor.

When presented to the Academy of Sciences by the Astronomer Jannsens, he was welcomed in a very flattering speech, and in return asked that he might present to the great academy a phonograph, by means of which the voices of its eminent members may be preserved for posterity. No one hereafter would then feel the chagrin and sadness he had felt when, passing the bust of Ampère in the corridor, he mourned that the voice of the great master was now lost to the world for ever.

As a rare exception and honor, Mr. Edison was asked to witness the banquet of the 13,000 mayors, and has himself been banqueted twice by French savants and electricians.

The honors yet in store for the great American, who is so modestly and worthily renewing the prestige of his

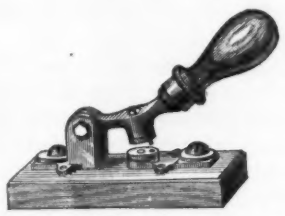


Fig. 3.—New Electric Light Switch.

country in France, will probably receive their fitting climax by the offer of the cross of the Legion of Honor—an honor that will but reflect on its donors.

An Improvement in Switches and Fuse Boxes.

The Electrical Supply Company, of Chicago, has recently designed and put upon the market various improvements in electrical supplies that are deserving of special notice. Difficulty having been experienced in the past with electric light switches, that upon opening or closing the circuit causes trouble by sparking, the snap-switch has come into general favor. A snap-switch is not always desirable, it is claimed, however, and there has been an increasing demand for a switch that is slow in its action yet as non-sparking as the snap-switch.

Fig. 1 represents a new double pole switch for electric light work. As will be seen by the cut, when the poles are thrown out of circuit, the current is continuous from one binding post, through the curved wire and elbow, to the other binding post. Now, as the handle is slowly pressed down, throwing the poles back into the circuit, the contact is begun before the elbow leaves its connection with the curved wire. By this simple means the current is never broken, making the switch absolutely safe to handle, and most desirable for general work.

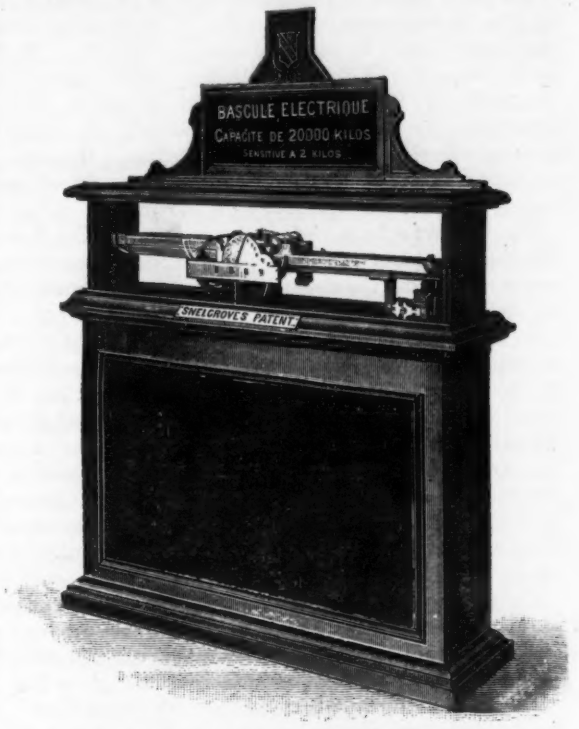
Fig. 2 illustrates a ceiling switch of different construction, but acting on the same principle as Fig. 1. The little arm at the back is so made as to allow the handle to be pulled down to throw the poles into complete circuit, but no further. It may be operated from the floor by a hook attached to a pole. Both these switches are mounted on handsome ebonized bases and are ornamental in appearance.

Fig. 3 shows a very simple and desirable switch, which attains a perfect contact on two broad surfaces of copper, and is securely held in position by a small rigid pin, without complicated construction. Its simplicity and strength should recommend it.

Figs. 4 and 5 illustrate the new "extra test fuse box," brought out by the Electrical Supply Company. The main point of difference in favor of this fuse box is the additional fuse, which, should the other fuse at any time be burned out, may be brought into service by screwing down the small thumb screw upon it, thus keeping the entire loop in circuit. This fuse box is especially valuable in determining the nature of any difficulty that may occur, whether temporary or permanent.

Snelgrove's Electric Weighing Machine at the Paris Exposition.

We show a perspective view on this page of the complete Snelgrove electric weighing machine as on exhibition in France and England, and which we described fully and illustrated in the issue of Sept. 7. As will be noticed in



The Snelgrove Electric Weighing Machine.

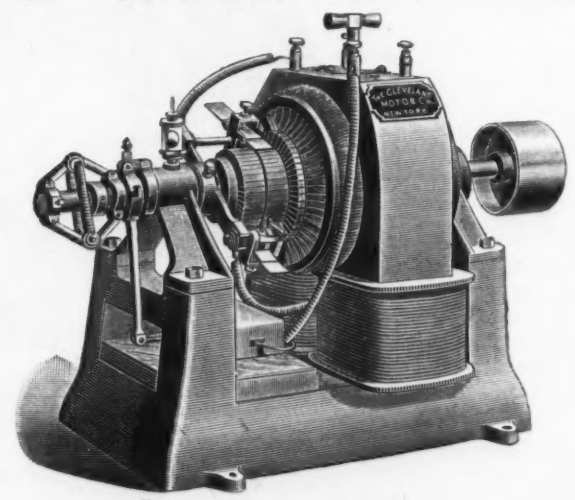
the figure, the whole machine is very compact and tastefully and handsomely finished.

The New Cleveland Arc Motor.

The application of electric motors, run from the arc circuit, continues to increase steadily, and this week we illustrate the new Cleveland motor designed especially for this purpose. It is the outcome of several years' work, and is now shown in its completed form.

The field magnets of the machine are of the well known Kapp type, as seen in the figure, the bed plate forming the yoke, and supporting the two bearings. The coils of the field are wound in sections, the terminals of each section being brought to a switch of novel construction, having air spaces between each section in place of mica or other insulating material, allowing all metallic or other dust to fall through and not remain upon the sections, thus getting rid of the liability of short circuits. The field coils are cut in and out of circuit by means of an automatic centrifugal governor, fixed to the shaft outside the journal at the commutator end of the machine. It operates the lever of the switch, thus maintaining constant speed with any variation of load.

The armature is of the Gramme ring type, well ventilated and solidly constructed, the coils being connected in the ordinary manner to a commutator which is constructed of a new metal alloy that does not cut or burn when running, and requires practically no attention, but will outlast



New Cleveland Arc Motor.

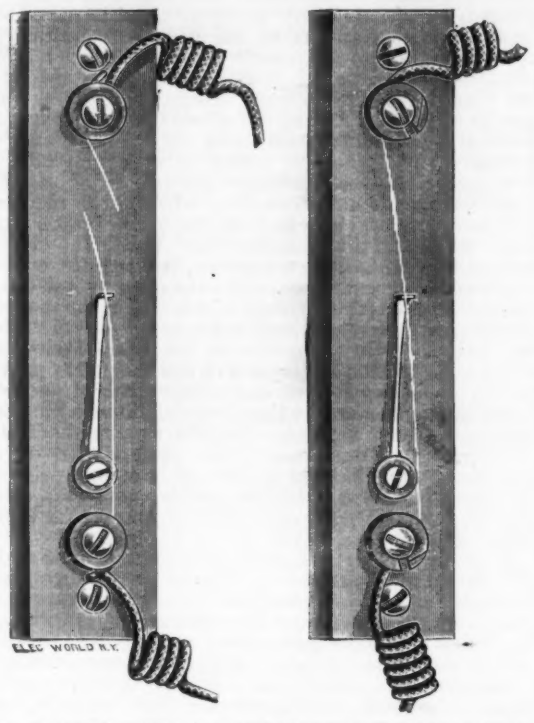
any commutator made of ordinary metal. The whole machine is so designed and proportioned that even with great variations of load and current it runs without any sparking at the brushes.

The bearings throughout are of the finest obtainable metal, and the shaft is made from a high grade of tool steel.

These machines are doing a remarkably successful power business running passenger and freight elevators, large lithographic and printing presses, and all kinds of heavy and difficult work which puts their powers to a very thorough test, under which they are said to be giving universal satisfaction. They are manufactured by the Cleveland Motor Company, of this city, who build for the arc circuit exclusively, and are to be congratulated on their success thus far attained.

The Clarke Instrument Protector.

An item of frequent occurrence in the expense account of every telephone or telegraph station is that of repairs to instruments "burned out" or injured by the crossing of telephone or telegraph wires with the larger copper conductors conveying heavy currents sent out from incandescent electric light or electric railway plants. Only a few weeks since thirty-six telephone instruments were more or less destroyed by the crossing of the exchange wires with the main wires of a railway system. Lightning also often causes much damage to instruments, and on the approach



FIGS. 1 AND 2.—THE CLARKE INSTRUMENT PROTECTOR.

of storms of probable great severity, it sometimes becomes necessary to cut off all outside communication for a short time to prevent the possible destruction of all the instruments.

To lessen the chances of injury occurring to instruments used on electric circuits through any of these causes, and to do away with the inconvenience mentioned, Mr. George D. Clarke, of Chicago, has devised and patented the instrument protector which we illustrate to-day, and which has been in constant and practical use for more than a year on lines operated by the Central Union Telephone Company.

As shown in Fig. 1, the protector consists of a base of hard wood, or other insulating material, which is attached to the wall inside the building where the instrument is located. Two sections of fine iron or steel wire are then lapped and soldered with an alloy flowing at about 212 degrees Fahrenheit, connected to the upper binding screw and passed through the eyelet in the metal spring to the lower binding screw, to which it is connected with sufficient firmness to reduce considerably the height of the spring. From the lower point the positive wire passes to the instrument, the negative wire going thence to ground. In the event of lightning striking the wires or a cross occurring with wires carrying heavier current, the solder on the small wire of the protector instantly flows, while the tension of the spring aids in breaking the circuit and separating the ends sufficiently far apart to prevent any arcing across. The line being open, no further injury can result, and the total cost of repairs is a cent or two plus the slight item of labor required.

Fig. 3 represents an improved form of lightning arrester and protector combined, by means of which the current is carried to the earth from the copper plate against which the copper spring rests, when the joint in the centre of the steel wire is melted by the heat of a heavy current and releases the tension, thus leaving the main line open. The method of weaving the steel wire affords perfect contact, enabling the lightest current employed to pass uninterrupted, while the strength of current to be arrested is controlled by the alloy used, which should flow at a temperature of less than 212 degrees Fahr.

The Beach-Cook Telephone Switchboard Transfer System.

The Central Union Telephone Company, operating nearly all the exchanges in the States of Ohio, Indiana, Illinois and Iowa, has recently adopted improvements worthy of attention, in connection with the switchboards of its medium-sized exchanges. In all such exchanges the company uses the "Standard" Western electric switchboard, grouped in sections for fifty wires each. Many worn-out boards are being renewed and central offices removed to permanent quarters, etc., and the company has abandoned the customary plan in such cases of forwarding boards in separate sections, to be set up and wired at the destination. Instead of this, the several sections of a proposed board are assembled at the company's repair shop in Chicago, where they are encased, equipped with cross-connecting boards and wired complete before shipment. The advantages gained by this plan are a substantial and uniform method of wiring, and a saving of much expense, heretofore unavoidable, in transferring from place to place for that purpose, men expert in such work.

We have shown on this page, in Figs. 1 and 2, a switchboard of eight sections, with a capacity for four hundred wires, which has been completed for the Youngstown, O., Exchange. An important feature of this board is an improved transfer system by means of which calls received for connection with subscribers whose spring jacks are located beyond the reach of the answering operator, are instantly thrown to the second operator, who is at the same time automatically signaled, the connection being completed without delay, extra motions, or the necessity for conversation between operators, and consequent confusion. A detailed description will not be attempted in this article, but will follow in a later issue.

This transfer system is the invention of Messrs. Beach and Cooke, of the Central Union Company; is thoroughly practical, without complication, and is already in successful operation at several of the company's exchanges, the number of subscribers in each ranging from 500 to 800.

The Toledo, O., exchange, with over 1,000 subscribers, is to be equipped with this style of board and transfer, provision being made for ample growth.

As many inquiries are being received regarding this transfer system, the Central Union Company will exhibit the Youngstown board at Minneapolis during the telephone convention, and it will no doubt attract attention, especially on the part of those who are operating medium-sized exchanges, and desire to avoid or defer the expense of multiple boards.

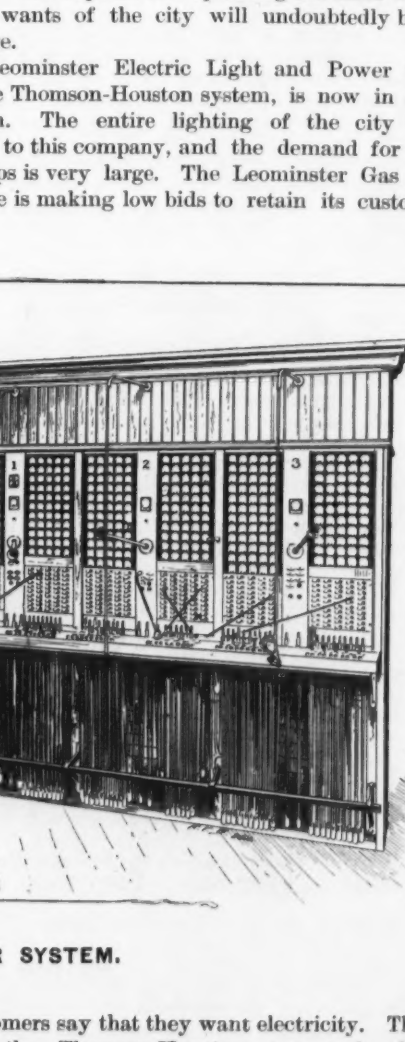
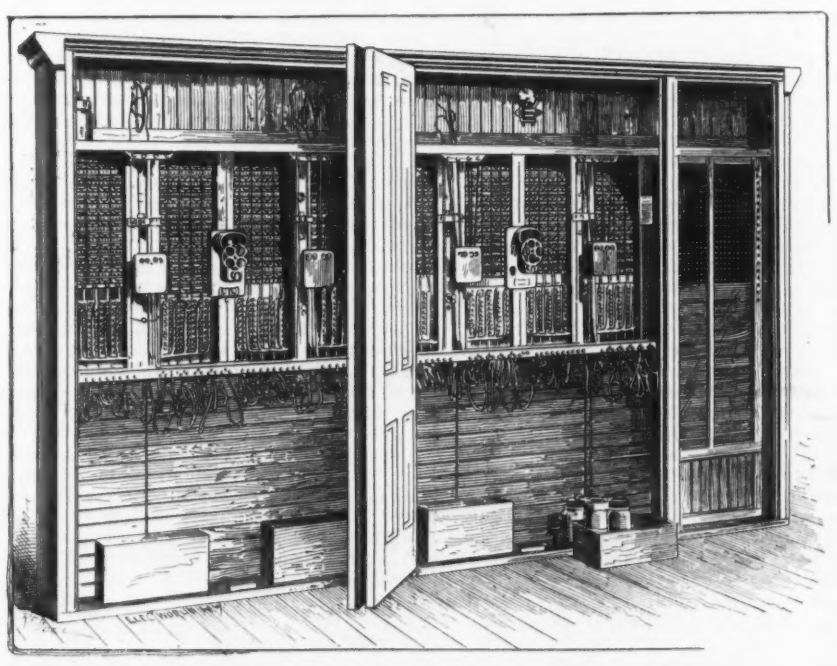


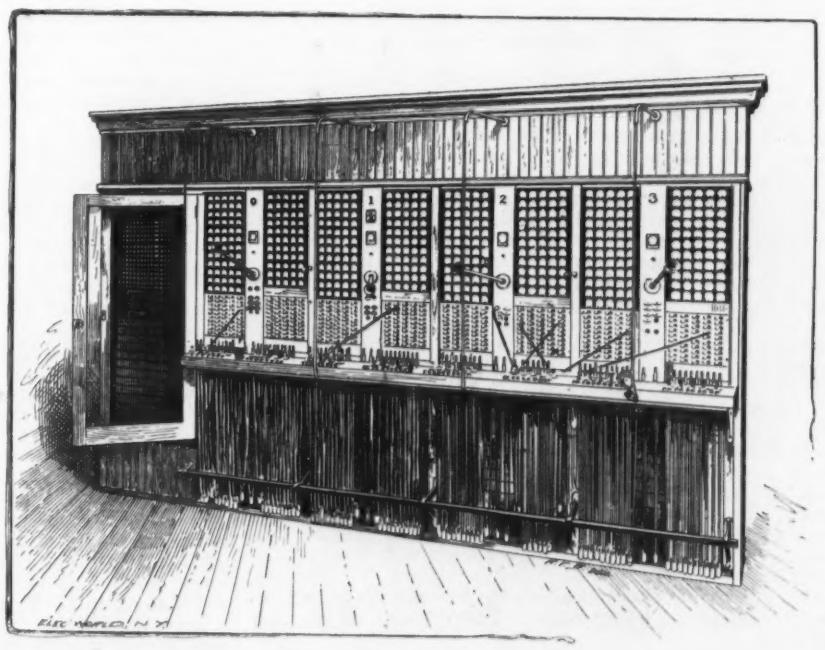
FIG. 3.—THE CLARKE INSTRUMENT PROTECTOR.

miles out of the city. The machinery used is the Thomson-Houston arc dynamos and the Thomson-Houston alternating current incandescent dynamos. The motors are run from the arc circuit, and are manufactured by the Excelsior Electric Company, and additions to the plant, both in motors and lights, are being constantly made. The company has ample water power at its command, having a first privilege capacity of 150 h. p. every day in the year from 7 o'clock in the morning until midnight, and a second privilege of 200 h. p. more which can be easily made use of if desirable. The electric company has established a mill in the city for grinding grain and is doing a large and successful business in this line; uses the Odell roller mill and it is working satisfactorily. Small motors are used in various parts of the city and with good success.

The gas company there, as in many other places, is making a strong effort to keep the electric company out, but the citizens demand a better light than they have been receiving from the gas company. The city itself is still lighted with gas, but will probably make a contract at no distant day for arc and incandescent lights on the street. The Belfast Company has one of the most promising outlooks for financial success of any plant of its size in the vicinity. The expense for operating the same will be low, and the wants of the city will undoubtedly bring large patronage.

The Leominster Electric Light and Power Company, using the Thomson-Houston system, is now in successful operation. The entire lighting of the city has been awarded to this company, and the demand for incandescent lamps is very large. The Leominster Gas Company of course is making low bids to retain its customers, but the customers say that they want electricity. The system used is the Thomson-Houston arc and alternating. This company will also supply the power for the new Leominster and Fitchburg electric street railway. This plant is controlled by leading citizens in Leominster, Mr. E. A. Buffington, a large shirt manufacturer, being the president, and Mr. Hamilton Mayo, president of the bank and the leading attorney of the town, the treasurer of the company. The capital stock is $30,000, all of which has been subscribed for and paid in, and a meeting has been called to increase the capital stock of the company for the purpose of enlarging the plant. The results of the first month's run of the company shows that it starts off with a business which will pay 6 per cent. on its capital.





FIGS. 1 AND 2.—THE BEACH-COOK TELEPHONE SWITCHBOARD TRANSFER SYSTEM.

Electricity versus Gas in the East.

The establishment of electric lighting and power companies at Belfast, Me., and Leominster, Mass., has been successfully accomplished in the face of active opposition from the existing gas companies, and the companies are now officered and managed by most capable men who will not suffer their best interests to lag. The Belfast plant is operated from a water power, situated one and one-half

The New Edison Station in Brooklyn.

We have been furnished with a number of interesting details about the new Edison station in Brooklyn, and present them below:

The building has been erected in 90 days, and is the most complete one of its kind, being entirely fire-proof in every respect. Messrs. J. & L. Weber, of New York City, were the contractors. Although not quite completed, it is in shape for starting, and will be entirely finished in a few weeks. The smoke stacks are the highest in Brooklyn, being 160 feet high, and there will be a large incandescent lamp of 300 c. p. on the top of each one that will be seen all over the city.

The steam plant consists of twelve Ball engines of 300 h. p. each (each engine weighing 18 tons) and eight Babcock & Wilcox boilers of 450 h. p. each.

The engines, contracted for by C. R. Vincent & Co., are compound, high-speed, and are the latest developments in this class of engines for electric light work, and will, it is said, produce higher results in regard to economy than anything ever before attempted. The contract for these engines was one of the largest that was ever given to any engine firm, and under the strongest kind of guarantee. The steam pressure carried will be 150 pounds, and an economy of three pounds of coal per horse-power hour will be obtained. The arrangements for the steam plant are very complete, and to prevent, as far as human ingenuity can do, any possibility of a break-down, everything is put in duplicate, including the steam piping.

The electrical plant consists of 24 dynamos of 1,500 lights each; they are the latest type of Edison machine, and weigh 10 tons each. In the dynamo room is arranged the electrical apparatus that controls all the machines in this room and also all the outside lines. The underground system, as at present installed, includes 25 miles, and covers quite a large district, which will be extended as the business is secured. There are no overhead lines installed whatever. The general offices, workshops, show rooms and supply rooms of the company will be located on the top floor of the building. The building is equipped with everything in the electrical line, including elevators run with electric motors, forced draught for boilers, etc., and the plant is the most complete that has ever been installed by this or any other company, and represents the latest type of developments in the electrical field.

Habirshaw insulated wire is used for the bus wires and for the apparatus generally.

The following are some of the places that have been already wired up to use the light: Park Theatre, lighted up Sept. 2; McDonald Building; Mansion House; Pierrepont House; Dieter's Cafe; J. M. Horton Ice Cream Company; Huyler's, Fulton and Hoyt streets; Commonwealth Lodge, F. & A. M.; Harding & Co.; Young Men's Christian Association; Wilson Ice Cream Company; Gordon L. Ford; Packer Institute; Brooklyn Tabernacle, where Talmage will at once hold forth under the electric light; T. K. Horton & Co; Alva Pearsall; Balch, Price & Company; Gage & Tolner; George Elford's Son; Cowperthwaite's; J. E. Brown. The majority of these buildings, etc., will be lighted by Sept. 9.

The company is under the management of Mr. C. J. Field, as general manager and constructing engineer. He has a very efficient staff of young men with him; in fact, the company is managed by young men entirely, who have had the entire charge of the construction, and will have of the operation of the station, as follows: Mr. W. S. Barstow, superintendent of electrical plant and underground; Mr. E. J. Cook, superintendent of steam plant; Mr. F. Uhlenhout, Jr., electrician; Mr. H. U. Pollard, superintendent wiring department; G. L. Morse, consulting architect; T. Guillandew, chief engineer of station. The other officers of the company are: Eugene Crowell, president; C. E. Chinnock, vice-president, and R. C. Peabody, secretary and treasurer.

Telephony.*

BY M. DE LA TOUANNE.

Telephony, greatly to the advantage of mankind, has, in less than ten years, invaded the entire world, and the telephone, looked upon at first as a scientific toy, has proved the foundation of an industry which extends its domain from the small hamlet to the most important cities. But the very rapidity with which this industry has developed carries in itself a serious inconvenience. Scarcely is one system adopted than another more ingenious and more practical is brought out, and we have seen in a great city a company, jealous of its good name and anxious to make its service of the best, abandon a system whose establishment was barely terminated, and cast away installations just completed, to begin again the organization at its base and create anew, in all its details, a system in harmony with recent progress. Such a course is but very rarely necessary; and since, on a smaller scale, these difficulties occur every day, they would in many cases be avoided by more frequent intercommunication between those who are at the head of these enterprises. Questions concerning the lines, the instruments, the exchanges, the tariffs, assume a hundred different aspects, and in the period of groping in the dark which we are yet passing through it is of paramount interest that the competent authorities should be able to discuss with each other the problems now being attacked and those which have been solved.

With regard to the lines, it appears certain that but one opinion exists as to the conductor. Copper and its alloys are gradually being substituted for iron and steel. Still it should be necessary to determine in which cases the use of copper possesses incontestable advantage, to know the results obtained under the most varied conditions possible with the bronzes, with hard copper and with annealed copper. This last, owing to its low tensile strength, seems to be confined to cables; but the cables themselves do not seem to have reached a state incapable of improvement. There exists a great variety of types; what are their precise descriptions, their advantages and their weak points? What resistance and what capacity are practically possible? How many wires can be conveniently placed in a single cable? What modifications can we introduce in the manufacture of the cable according to its employment on a metallic or grounded circuit? What are the lessons which experience has taught us with regard to this? On this point of metallic circuits, what devices of construction are employed in aerial networks? Is it not possible, as has recently been proposed, to reduce the number of conductors and to employ a single return wire for a group of line wires? Following this hypothesis, what methods would be eligible for the juxtaposition, on the same supports, of several similar groups, etc.? Here are then a collection of problems of which we shall not obtain a solution, even moderately trustworthy, unless a certain number of practical men, who will confine themselves to actual facts, are willing to discuss them and communicate to each other the history of their failures as well as of their successes.

The instruments do not present such a varied field for comment, at least if we keep to results which have been undeniably proven. Microphones, telephones and the auxiliary apparatus can be divided into only a few classes. The multitudinous models due to the fertile imagination of the inventors could be easily compared and classified; often the differences are confined to details of purely commercial interest. The microphones, derived from the discovery of Hughes, have the great advantage that they are adjusted once for all. Those inspired by the Edison microphone are, however, preserved in many systems, and lastly, the granulated microphones were momentarily considered as an improvement.

If the precise methods of measurement at present being studied should not readily give collective results, it would be desirable that the drawbacks of the different systems, as shown by daily use, should be placed in evidence.

The telephones themselves have also exercised inventive genius. Their principle being known, the different forms of electro-magnets necessarily had to be tried; and the inventors would frequently have refrained from presenting certain forms as new if they had consulted some of the old works on electro-magnets, those of Nickles, for example. In short, at the present day, I believe that there are in existence several types of telephones of very similar merit, all of them good if they are well made. It is desirable to promote progress in this direction to determine the exact relative influence of the constituent parts of the instrument.

The auxiliary apparatus, bells, annunciators, etc., are modifications, sometimes productive of good results, but not always so, of telegraphic apparatus which has undergone a long ordeal of trial. The same may be said of many combinations in which these accessories are used; the Wheatstone bridge, differential connecting, etc., which are adopted purely from telegraphy. When we only have to do with an adaptation of the Morse, or with a bell or an annunciator, we encounter no novelty. Innovation, which might be extensive, only comes to the front when it is required to group several subscribers on a single line from the exchange, or in the devices destined to automatically effect communication with a customer on payment of the specified toll for a conversation.

Among the accessories, one of the most important, the battery, is perhaps that which affords most room for difference of opinion. A decision as to the most favorable element for the transmitter would be useful.

With regard to the exchanges, there are many points which merit special attention. The most important questions concern the switchboards. What special facilities ought they to possess? Starting from what number of subscribers ought an exchange to be furnished with that admirable system of multiple switchboards, which, hailing from the New World, is gradually penetrating into the Old? Here we are confronted by elements, the knowledge of which is indispensable. The simplification and the accuracy of the operations which are required of the employé are of the greatest importance when these operations have to be repeated several hundred times a day. The primary outlay becomes then of secondary moment, the reduction of expense is frequently more apparent than real. In any case, even if it be purchased at the price of a temporary sacrifice, promptness, which is the *raison d'être* of telephony, is the first element to be sought after. And the diversity of systems is such that, according to the type of switchboard adopted, the number of calls attended to and communications effected by one operator ranges from 200 per day to 200 per *hour*. These figures are not exaggerated; the maximum is still higher. Given these conditions, it is easy to see that special care is necessary in choosing the material for an exchange.

Nevertheless, the advantage of this care in making the installation would be lost if judicious regulations were not adopted to insure the proper use of the apparatus. It would be, therefore, very interesting to compare the regulations observed in different exchanges, the instructions given to subscribers and to employés, and to know what advantages or what weak points have been revealed by experience in their application. To cite merely one detail: in the New York exchanges every call for communication is considered as being on record and "alive" until it has been complied with. In the majority of other administrations the custom is that the subscriber has to repeat his call if he has been advised at first that he cannot be connected immediately with the number he requires. Of the two methods, the first secures to the subscribers an apparently undeniable advantage; but it would be necessary to consider at the same time to what degree it hinders the service to the detriment of subsequent calls; on the other hand, it seems that at the expiration of a certain time the subscriber would relinquish his turn to communicate. The arguments for or against can only be furnished by those who have had experience with both methods. This particular point is, of course, mentioned solely as an example, and only shows the difference in the views entertained by competent men, and the uncertainties which still exist.

Another cause of the prosperity or the reverse of telephone enterprises is the tariff which they adopt. Like all industries, the telephonic industry aims at once for the *profitable tariff*, that which, by the combination of the number of subscribers and the rent which they are charged, will give, after deducting all expenses, the maximum return for the capital invested. The estimate of expenses is difficult to make in a general way. They depend not only upon the material used, but also upon the local surroundings; in each particular case, however, they are an element which can be known fairly accurately. The second element, the law of selling price, so to speak, the law according to which the rate is in relation to the number of calls or the number of subscribers, is, on the contrary, completely unknown. Anticipations formed in this matter are almost always erroneous. It would be then a most interesting achievement to enunciate this law; unfortunately, the first items requisite are rarely shown. As a general rule the rates are fixed and modified without any previous plan; reductions (no mention is made here of additions, which are exceptional) are made by brusque and irregular drops, and it becomes a delicate point to review the relation between the lowering of the tariff and the increased demand for telephonic service. With regard to the conclusions to be drawn from comparisons between the numerical importance of the population and the number of subscribers, they afford us but slight information. For the same town the significance of the numbers embraced in these concise statistics depends on several circumstances: On the date of establishment of the exchange, or rather its period of service, on the time during which the latest tariff has been in force, on the regularity of the service, all of which items are generally omitted. If we wish, aside from this, to contrast with one another results obtained in different localities, it is again necessary to know the characteristics of the inhabtants, the nature of the social relations which obtain and result from the ordinary occupations, from the climate, from the wealth and from the nature of the mercantile operations. Up to the present the telephone is above all a commercial instrument, and it would be easy to classify by themselves the towns where it possesses only a special interest. Among the others it would be important to draw a parallel between those only which are really comparable. Concerning industrial or commercial cities, it would probably be necessary, for one thing, to distinguish among the industries those which give rise to but few transactions, but which are important by the amounts dealt with, and those, on the other hand, in which the sales and purchases are numerous, but require only relatively small expenditures. For the commercial cities another accurate criterion might be found in the movements of the stock market. These items, coupled with information as to the value of money in the countries under consideration, and the statements of the telephone statistics, would probably allow of our conjecturing the probable development in store for the telephonic industry amid well-understood surroundings. Outside this methodical procedure, we shall only meet with uncertainties or disappointments equally fatal to the spirit of enterprise. The problem, moreover, is a most knotty one, and the sole object of the foregoing remarks is to point out its interest and complexity.

In conclusion, we cannot expect an immediate and complete solution of all the questions touched upon in this hasty review of telephony, and others which have not been mentioned would still remain to be solved. But it appears to me that several of them might be attacked with good result by men who are daily battling with the practical difficulties, and by making common stock of their experience; happy if scientific results were yielded, throwing a clear light on some of these many unsettled questions.

* Report presented to the International Electrical Conference, Paris, August, 1889.

The International Electrical Conference at Paris.

From our Special Correspondent.

Paris, France, Aug. 27, 1889.—On Friday evening, Aug. 23, a preliminary meeting was held, under the auspices of the Société Internationale des Electriciens, of Paris, and the Institution of Electrical Engineers, of London, in the rooms of the former, at No. 44 Rue de Rennes. Over one hundred and fifty members were present, and the meeting was a most enjoyable one.

Sir William Thomson presided and was assisted in his duties by Messrs. Preece, Douglas-Galton, Carpentier, Sébert, Hughes, Edison, Mascart and Graves. At nine o'clock Sir William Thomson called the meeting to order and presented Colonel Sébert, who, on behalf of the Société Internationale des Electriciens, of which he is president, made a very neat address of welcome. This was responded to by Sir W. Thomson, who expressed thanks for the kind words of greeting from his French brother, and spoke of the wonderful strides which have been made in all branches of electrical work during the last decade. He recalled the time, eighteen years ago, when he first saw a Gramme dynamo. It was in the laboratory of Thomas Andrews, of Belfast, and great was his delight and wonderment when he saw one machine run the other as a motor. He then spoke of the first Electrical Exhibition and the first Electrical Conference ever held—that of 1881—how that was an example followed by almost all the civilized nations. He also remarked how at that time they still lacked definite units. Then, going on to the Congress of 1883, he dwelt particularly on the strides electricity had taken in the two intervening years, and on the excellent work the Congress did for all electricians by establishing fixed units of electrical measurement, and how the various workers in electricity have now gone beyond the work of the Congress of 1883 and created words of their own to fill the various needs at once developed; how what was looked upon as experimental six years ago had developed into enormous industries, involving many millions; how the electric light and the telephone were things of the family. He also hoped that, although they had not subjects of the same deep importance to dwell upon at this conference, they would nevertheless accomplish much excellent work and be enabled years hence to look back upon their actions and deliberations now with as much pride as they could look back upon the Congresses of six and eight years ago.

M. Mascart, President of the Committee of Organization of the Congress, then addressed the meeting and gave it some idea of the work to be done by the members of the conference.

The inventor of an artificial silk was then given the floor to explain how he manufactures his wonderful commodity out of fine boards, and his story of how he followed out the processes of nature, as fulfilled by the silk-worm, was very interesting.

M. Carpentier then gave an explanation and illustration of his new method of recording electrically and reproducing mechanically music played on a piano, as demonstrated by M. Abdank before the American Institute of Electrical Engineers last December. Mr. Edison's phonograph was then presented and elicited much admiration.

The meeting adjourned at 10:30 o'clock, to come together at the formal opening of the Congress the next morning at 10 o'clock.

On Saturday, Aug. 24, the conference was formally called to order at 10 A. M. in the Palais du Trocadero.

President Mascart, in the name of the French government, welcomed the foreign delegates, and, after declaring the conference open, announced a short adjournment for a caucus for the nomination of officers.

Upon reassembling Sir William Thomson proposed M. Mascart as president of the Congress, and he was elected unanimously. Upon assuming the chair M Mascart thanked the Congress for the honor done him.

Sir Wm. Thomson was nominated as honorary president by M. Fontaine, and elected unanimously. The full list of officers is as follows:

Honorary President: Sir Wm. Thomson.
Presidents d'honneur: Messrs. Cochery and Berger.
President: M. E. Mascart.
Vice-Presidents: Messrs. Ferraris (Italy), H. Kareis (Austria), Potier (France), Preece (England), Rousseau (Belgium), Stoletow (Russia), Weber (Switzerland).
General Reporter: M. Joubert.

The president then read the rules prepared by the Committee of Organization, which were adopted, and M. Carpentier was charged with the general supervision to facilitate the work of the Congress. The president proposed the division of the Congress into sections, and after some discussion by Messrs. Mascart, Gariel, Fontaine, Sciama and Carpentier, the Congress adopted the following division:

Section I. Units and measures.
Section II. Industrial applications of electricity.
Section III. Telegraphy, telephony and signaling.
Section IV. Electro-physiology.

The following were then elected officers, respectively of the various sections: I. President, M. Lippmann; II. President, M. A. Potier; III. President, M. Fribourg; Vice-Presidents, MM. Hughes and Banneux; Secretaries; MM. de la Touanne, Brojlinski, Sartiaux; IV. President, M. Gariel; Vice-President, M. Tripier; Secretary, M. Broca.

MONDAY, Aug. 26, 1889.

PROCEEDINGS OF SECTION I.—*Units and Measures.*

M. LIPPMANN thanked the section for the honor done him in nominating him President, and the following officers were then elected: Vice-Presidents, MM. Bjerknes and Stoletow; secretary, M. Violle; associate secretaries, MM. Armagnat and Lepage.

The work of the Section was opened by M. Bjerknes, who gave a resumé of his new researches on the analogy between hydrodynamic and electrodynamic phenomena. Admitting, first, that the coefficient of superficial viscosity is extremely small relatively to the coefficient of internal viscosity, and second, that the density of the fluid is very small, and therefore that the quotient of the internal viscosity divided by the intensity is very great, he determines the conditions of a double system of pulsating spheres, and finds by reversing the signs the formula of Ampère, or more simply that of M. Renard.

In the name of M. Pellat, the president transmitted to the Congress the proposition to adopt the electrodynamometer balance as the standard instrument for measuring the strength of currents.

Sir WILLIAM THOMSON considered the electrolytic method as the most simple and exact one for measuring current strength; the decomposition of sulphate of copper with the precautions indicated by Thomas Gray, his former pupil, was the method which he employed to graduate his electrodynamic balances. This method of standardizing presented no difficulties between a range of $\frac{1}{100}$ and 500 ampères. The small corrections necessary for the density of current and the temperature are easily determined, and the range of precision is certainly within $\frac{5}{100}$ per cent. The voltameter in connection with the well-known apparatus for measuring the resistance satisfies in a very simple manner all practical requirements.

M. MASCART coincided with Sir William Thomson and added further that in the carrying about and manipulation of an electrodynamometer there were chances of error which did not exist in the case of the voltameter.

M. LIPPMANN coincided with M. Mascart and found in the great simplicity of the voltameter an argument in its favor. Under these conditions he questioned the necessity of the Congress occupying itself with the establishment of a standard instrument, and the Section considered that the question ought to be reserved for further discussion.

Sir WILLIAM THOMSON, referring to the question of potential measurements, drew attention to the great interest taken in them and to the information contained in the report of M. Pellat relative to standard cells. He drew special attention to the importance of electrostatic standards for the measurement of high potentials, and remarked that an electrometer for 5,000 volts potential could at present be constructed more easily than an electrodynamometer.

M. LIPPMANN drew attention to the fact that for an electrometer standard proper, for the measurement of electromotive forces below one volt, the capillary electrometer could be used. All instruments of this nature could be compared with each other, and were sensitive and constant. The same electromotive force, E, exerts in each of these apparatuses a comparative pressure expressed by the same fraction, $\frac{\alpha}{n}$, of the original height. If, for example, α is equal to $\frac{1}{2}$, E is the electromotive force which increases the capillary constant by $\frac{1}{2}$ of its initial value. The instruments with capillary tubes in use are sensitive to $\frac{1}{40000}$ of a volt, and they could besides be simplified if it were required to reduce them to standard instruments.

Tuesday's session will be devoted to electrical nomenclature and notation.

PROCEEDINGS IN SECTION II.—*Industrial Applications.*

The section was called to order by the President, M. Potier, and completed its organization by electing the following officers: Vice-Presidents, MM. Ferraris, Hippolyte Fontaine, Prof. G. Forbes; secretary, M. E. Hospitalier; associate secretaries, MM. C. Jacquin, J. Laffargue and G. Roux.

M. Crova opened the session with a discussion of the photometry of incandescent lamps. He demanded that the Congress should come to some understanding on this subject, and that the following should be clearly defined: First, the normal operation of an incandescent lamp (voltage); second, the color of the light; and third, its illuminating power. If one constructs the curves of the illuminating power of the various rays of a Carcel lamp and of a Sun arc lamp as a function of the lengths of the wave, there will be found a common ordinate corresponding to a wave length of 582 millionths of a millimeter. This can be practically realized by passing the luminous rays through a definite solution of the chloride of nickel and chloride of iron; it would then be possible to compare the illuminating powers of different sources of light with relation to this tint. As to the comparison of tints, they could then be easily effected by comparing the values of the red ray in each when the illuminating powers are equal and the length of the wave chosen is 557, produced by a glass colored with sub-oxide of copper. The red tints of the "Sun" lamp and the Drummond light compared to the standard Carcel lamp are respectively 0.5 and 0.94; the standard red tint should be determined between these two limits. For the same incandescent lamp run between 30 and 90 watts, the tint varies from 1.33 to 0.88.

The horizontal intensity would be determined by giving the lamp a rotary motion so as to obtain a uniform illumination. We would then be able to define the normal operation of an incandescent lamp as that at which it would have the tint of a Carcel lamp or any other unit determined upon; for arc lamps it would suffice to use the wave lengths 582 and the dispersion photometer.

M. R. V. PICOU remarked that it was impossible to define the normal voltage, as it depended upon the conditions of the installations and the cost of electric power, to which M. Crova answered that the thing to be determined was simply to obtain a term of comparison. M. Potier added that these figures given would be very variable with time. The discussion was postponed to the following day.

M. E. BEDE, of Brussels, then read a paper on a Combination System of Heating by Steam or Water with Electric Lighting. He pointed out that the heat lost in a gas engine, or a non-condensing steam engine, could be utilized to heat a building lighted by electricity. The difficulty resulting from the fact that the lighting is only done at night, whereas heat is required throughout the day, could be overcome by the use of accumulators, which could be charged during the day, and which during the night would assist the dynamos in the lighting; the charge to be given to the accumulators could be regulated by inserting resistances in the fields of the dynamos, so as to reduce the output of the latter without changing the pressure, so that a continuous heating would be possible. The cost of such a combined lighting and heating plant would be about the same as those for separate lighting and heating plants, because the cost of the accumulators is compensated for by the reduction in the size of the dynamos, engines, etc., required, all of which could be reduced in size by this arrangement. For the same reason the cost of fuel and oil could be considerably reduced, and experience has shown that this method of employing accumulators permits of a considerable economy as well as uniformity in the lighting. M. Bede also pointed out that the same application could be made to dynamos driven by gas engines, by employing the heat absorbed by the water circulating in the cylinder jacket, and circulating it through pipes to heat the building.

PROCEEDINGS OF SECTION III.—*Telegraphy, Telephony and Signaling.*

The session was opened by the President, M. Freibourg.

M. MERCADIER presented a paper On the Nature and Intensity of Telephonic Effects. He showed that the telephone is usually composed of a disc fixed around its whole periphery and submitted to the action of a magnetic field. This constituted a very complex acoustic system: the plate has first its own vibration, that is, its fundamental one, which is obtained by fixing the plate at its centre; the nodal lines range themselves in two diameters at right angles to each other. For the first harmonic the nodal line is circular, its radius being about 0.65. In order to obtain the second harmonic, the disc is fixed at its centre and at two points in its circumference; the nodal lines are then ranged along three diameters. The disc can take other movements, for which the molecules vibrate separately, that is, the non-coördinated movements of Helmholtz. It is these which characterize the consonants; they form an indefinite and continuous series. The sounds constituting the human voice are extremely varied and of considerable range. The effect of the vowel is to excite the harmonics; that of the consonants produces violent sounds and noises; that is to say, a superposition of sounds. The telephone produces articulate words because it reproduces the non-coördinated vibrations. According to M. Mercadier, we do not understand, indeed, how a disc, which is able to reproduce a limited and discontinuous series of sounds, is capable of producing articulate words; but we can take as a receiving plate a hollow disc pierced with holes, or a metal gauze. The quality of the sounds produced is then excellent. We can even employ a carboard disc, upon which is spread a small quantity of iron filings, about 0.05 gramme. There is then no longer a question of nodal line or waves.

Accordingly, therefore, by varying the telephonic membrane so as to cause it to reproduce its own sounds as little as possible, one can improve the qualities of the effects produced. Take for instance discs having a thickness of about two millimetres: if we reduce the thickness of a plate of two millimetres to 0.05 millimetre, we obtain a quality of sound that constantly gets worse. For a plate of 0.5 the timbre is very bad. We have thus to deal with two contrary effects, that is, the quality, which increases with the thickness of the plates, and the intensity, which diminishes very rapidly with the increase in thickness. It therefore remains to find under which conditions there will be a proper intensity in the quality.

Experiments have been made in the following manner: A metronome is made to strike the transmitting disc of a microphone, the current in which is maintained constant at 0.3 ampère in the primary circuit. The secondary coil is connected with the telephone, having a mounting of ebonite without metal. This telephone can slide on a scale of 2.5 metres in length, at the end of which is placed a plate having an opening against which the ear is placed, and which remains fixed. The point at which this sound of the noise ceases to be heard is determined. The square of this distance is proportional to the intensity of the sound transmitted by the telephone. M. Mercadier has employed discs of copper, chemically pure aluminium, and iron, varying from 0.12 to 2 millimeters in thickness. He has found the curve representing the intensity as a function of the diameter to be analogous to the curves of diffraction presenting a series of maxima and minima and decreasing rapidly. For iron the first maximum point exceeds by far all the others. For the D'Arsonval telephone the maximum corresponds to a thickness of 0.25 millimeters.

Telephonic effects, according to M. Mercadier, are due to two causes: First, the variation of the magnetic field, and second, the currents induced in the plate by the oscillating currents which circulate in the coil. These induced currents can be suppressed by slitting the disc radially. He also shows that in the iron about one-quarter of the effects are due to electro-dynamic induction for the first maximum. For copper and aluminium the electro-dynamic effect is the most important one, the magnetic effect being very small.

M. VLASTO inquired if M. Mercadier had made any experiment on the influence of the density of the telephonic discs, to which the latter replied that he had not yet done so for lack of time.

M. MERCADIER also presented the following papers to be read later on: On the Monotelephone or Electro-magnetic Resonator, and On a System of Multiplex Acoustic Telegraphy.

The following papers have also been presented, but have not yet been read: On the Application of Dynamo Electric Machines to Telegraphy, by Pierre Picard; On a New System of Long Distance Telephony, by H. Merczyng, of St. Petersburg; On the Multiple Printing Telegraph of J. Munier, by Paul Samuel; On the Relation of the Surroundings of Telephonic and Industrial Districts, by M. Pallaz.

PROCEEDINGS OF SECTION IV.—*Electro Physiology.*

President GARIEL opened the meeting by reading a memoir of M. Maurice Mendelssohn, entitled On Some Electrical Phenomena in Man, which was discussed by the members present, and the following paper was presented, but has not yet been read: Electric Motors for Driving Static Electrical Machines, by G. Trouvé. The following subjects will be discussed: Electrolysis, Electrogenesis in the Human Body, Errors of Measurement, and Measurements of Induction Currents.

WETZLER.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
167-177 TIMES BUILDING, NEW YORK, Sept. 7, 1889.

Mr. W. H. McKinlock and Mr. J. M. Thomas have been visitors in New York from the West.

Curtis & Dean, the local Thomson-Houston agents, are now busy installing some fine plants in New York State and Jersey.

Homer Brooks, 44 Barclay street, is the "original and only practical" glass, rubber, etc., mold maker in the city, and is abreast of all the new business coming up.

Mr. D. P. Perry, of the Sprague Electric Company, was a visitor in town this week, having run down from the White Mountains, where he has been summering with his wife.

Mr. A. A. McCreary's new shade for incandescent lamps is a great success, and it is being found useful, while at the same time its merits are readily recognized for artistic and decorative purposes.

The Electrical Accumulator Company, Mr. Truex tells me, are shipping some large orders to South America, and the call for storage batteries from the Southern and Western States is also active.

The Foster Regulator, made at 83 Fulton street, will regulate the supply of dry steam to engines with accuracy, and seems to me to be a first class adjunct to an electric light and power plant. Its operation needs only to be seen to realize its value.

Mr. C. Van Nuis, the electrical engineer of 18 Cortlandt street, is bringing out a fine new switch for heavy current work. It has double break contact points and a strong spring to break the contact instantly. It is said to overcome successfully either sparking or burning of contact points.

Mr. Chas. Hussey, of the Eclipse Electric Company, 144 Greenwich street, believes he has a bonanza in his new battery for light and power. He uses blue stone and copper for the base, and zinc enclosed in a porous cup for overcoming oxidation and deposition of the copper on the zinc. He is ready to guarantee it as "beyond compare."

American Institute of Electrical Engineers.—The thirty-seventh meeting of the institute, and the first of the season, will be held on Tuesday, Sept. 10, at 8 o'clock P. M., at the house of the American Society of Civil Engineers, No. 127 East Twenty-third street, New York. A paper will be read by Lieut. F. Jarvis Patten, Member, on "Alternating Motors: The Evolution of a New Type." Gentlemen interested who are not associated with the institute are cordially invited to attend.

Mr. A. Bell Malcolmson, Jr., 132 Nassau street, says he has the only practical oil burner in the world. One of the biggest electric light plants in the West is using it under its boilers, and is saving money. But for the policy of the Standard Oil Company he believes that oil would thus be largely used in New York City, but oil at $5 does not pay, and factories are hindered from burning crude oil, it is claimed, by the stringent restrictions on the subject, although the crude oil is not more dangerous than that used up town in making gas.

Newark Notes.—A call in Newark last week convinced me that there must be an immense demand for the McIntire connectors, which are now made for every branch of the electrical business. The Ghegan low-water alarm for boilers is having a large sale, and engineers, mill owners and others are beginning to appreciate its advantages. Hanson, Van Winkle & Co. are quite busy supplying plating machines, anodes, etc., for the plating trade, Mr. V. H. Emerson, the General Manager of the Newark Phonograph Company, tells me that the phonograph is becoming very popular in his territory.

The Fall Season is opening most propitiously. I find activity in electrical circles wherever I go. The supply trade has all it can do to meet the demand, especially for electric light supplies. Insulated wire is in the briskest demand. One big order placed with Mr. J. F. Kelly, of the Edison Machine Works, is for 50,000 feet of black covered wire. Habirshaw wire in the finest grades is also being appreciated, and such specialties as Grimshaw, Okonite and others are daily called for in large quantities. Several new motors are reported as ready to come on the market, and it is expected that one or two of them will surprise people.

C. R. Vincent & Co., 15 Cortlandt street, headquarters for Ball automatic engines, report the following plants and sales: Two 100 h. p. Ball engines for Plattsburg, N. Y., Electric Light Company; two 100 h. p. Ball engines, Catskill, N. Y., Electric Light Company; one 150 h. p. Ball engine, Haverhill, Mass., Electric Light Company; one 80 h. p. Ball engine, Portchester, N. Y., Gas Company; one 50 h. p. Ball engine, Helvetia Silk Mills, Paterson, N. J.; one 125 h. p. Ball engine, Yonkers, N. Y., Electric Light Company; one 150 h. p. Ball engine for Edison Electric Illuminating Company, of Paterson, N. J.; one 60 h. p. compound engine for Princeton College, Princeton, N. J.; one 30 h. p. engine for Iquique, Chili; one 25 h. p., Murphy Varnish Company, Newark, N. J.; one 100 h. p. engine, Stamford Electric Light Company, Stamford, Conn.

The Breslin, Lake Hopatcong.—Visiting Lake Hopatcong the other day, I could not fail to observe how well the arc light compared with the brightest moon. As it rained on my arrival the moon was obscured, and the only lights that illumined my way were those of the distant Breslin. Beautiful lights they were. Being of an inquisitive nature, I hunted up the plant next day, and after an hour's row on the lovely lake I came abreast of the Breslin Hotel, which is certainly one of the finest summer hostelries in the world. About a block from the hotel I found the boiler room, where is stationed a Ball dynamo, run by a Payne engine, furnishing 16 arcs of 1,200 c. p. each, and 10 incandescents of 125 c. p. each. The arcs are used to illuminate the grounds, while the incandescents shine in

the parlor and dining room. In the hotel corridor is one of the neatest and costliest annunciators ever built. It faces a clock of rich workmanship. Both were built by the New Haven Clock Company.

A New Steam Engine.—A new engine, for both marine and stationary purposes, has just been put on the market. It is an upright, duplex, high-speed engine, making anywhere from 1,500 to 3,000 revolutions per minute, and instantly reversible. Mr. Charles G. Emery, of New York City, the proprietor of the "Old Judge" tobacco factory, who owns a beautiful summer house among the Thousand Islands on the St. Lawrence River, became interested in the invention, and tried the first engine that was built, in his steam launch there. Its performance was so superior to that of other engines that he has taken up the manufacture of it. The Ames Manufacturing Company, of Chicopee, Mass., are making them, and the Hussey Re-heater and Steam Plant Improvement Company, 15 Cortlandt street, have taken the general agency for their sale throughout the United States, Canada and Mexico. The inventor of the engine is E. G. Shortt, of Carthage, N. Y., who has also invented an upright duplex steam pump, which embraces principles similar to the engine, and which will shortly be put on the market by the Hussey Company. W. T. H.

NEW ENGLAND NOTES.

Branch Office of The Electrical World,
Room 8, Cook Building, cor. Franklin and Congress Sts.
Boston, Sept. 7, 1889.

Fairfield, Me., has more incandescent lamps in residences than any other town of its size in the world. The Brush system is used, and the residents are all delighted with it.

Mr. Oscar Moll, of London, Traffic Manager of the Direct United States Cable Company, is on a visit to the cable offices of the company at New York, Boston and Rye Beach.

Mr. L. W. Janes, Superintendent of the American Electric Manufacturing Company, was in the city this week, arranging for the manufacture of a large number of American lamps.

In Town.—Mr. George T. Manson, of New York, Mr. Henry D. Stanley, of Bridgeport, and Mr. Cyrus O. Baker, of Newark, N. J., were in the city this week. Strange to say, they were together.

Suncook, N. H.—Messrs. Paine & Francis, of Boston, have contracted to supply the Pembroke mills with an Edison plant of 360 lights, with special automatic regulator. Waterpower will be used.

Rockville, Conn.—The Rockville Electric Light Company are putting in a plant of the Thomson-Houston system. The plant will consist of 110 arc lamps, 74 of which will be public lights. The Wright Electrical Engineering Company are doing the construction work.

Waltham, Mass.—The Committee on Streets gave a hearing to the Newton Electric Street Railway Company for the right to locate its tracks on Newton and River streets. The capital stock, $50,000, of this company has been paid in. At a recent meeting of the corporation it was voted to increase it by $50,000, and that amount is guaranteed.

The Standard Electric Company, of Vermont, have sold the following plants this week: Carl Mindt, Lisbon, N. H., 100-light plant; Parker & Young Manufacturing Company, Lisbon, N. H., 100-light plant; L. G. Turner, Willimantic, Conn., 300-light plant. The Standard Electric Company will furnish the complete installations, and the Sawyer-Man lamps will be used.

Mr. R. T. White, of 12 Pearl street, has just received an order from the Thomson-Houston Company for 10,000 of his T rail chairs for the Attleboro electric street railway. He is fitting up patterns as per their orders to get these chairs out for several other roads. Mr. White finds a ready indorsement for his rail chairs among practical men, and they are evidently coming into general use.

Shawmut, Me.—The Shawmut Fibre Company, of Shawmut, Me., the lighting contract for whose mills has just been secured by Mr. L. H. Rogers, of the Brush Electric Company, will soon be in actual operation. They will have the largest and best equipped wood pulp mill in the country when completed, and are desirous of putting in the most thorough system of electric lighting that can be procured.

Mr. L. H. Rogers, the New England representative of the Brush Electric Company, is now settled permanently in Boston, at 113 Devonshire street, and opens the campaign very auspiciously for his company with a contract for lighting the Shawmut Fibre Company's mills at Shawmut, Me. From all appearances, Mr. Rogers' name will appear frequently among the notices of "contracts secured."

Chas. A. Schieren & Co., the well-known belting people, will, on or about Oct. 12, remove their Boston house from 86 Federal street to new quarters at 119 High street, where they are fitting up one of the finest belting establishments in the East. They will carry there a large stock of standard and special grades of goods constantly on hand, in order to insure quick shipments. In addition to the office and salesrooms, they are fitting up a large repair shop, where they will be able to do all kinds of repair work at short notice. Enterprise of this character wins its reward.

The Camden & Rockport, Me., Electric Light Company was organized last winter, and is now running 376 Swan incandescent lamps, using 125 cells of battery from the Electrical Accumulator Company, charged by a Weston dynamo, driven by water power. The company, Mr. C. B. Story, the electrical contractor, reports, is putting in a 36-inch Holmes wheel and 75 h. p. boiler and engine as auxiliary. When this is started a number of lamps will be added. Accumulators have been installed in seven different plants in Maine, and have been running satisfactorily for over a year.

G. D. Haynes.—Mr. Haynes, who has long been well known as an electric supply man, in connection with Pettingell, Andrews & Co., of Boston, has now decided to go into the general electric supply business for himself. Mr. Haynes has been missed from his accustomed haunts on account of a protracted sickness, but has now come back with renewed energy to ask for the patronage of his many friends on his own account. He will make his headquarters at 149 Congress street, and will deal in all kinds of electric lighting apparatus and supplies, making a specialty of dynamos, motors, engines and boilers.

Mr. A. L. Russell, of 106 Sudbury street, issues a circular, saying: "I beg leave to inform my patrons and the public generally that I have resumed my electrical manufacturing business, temporarily interfered with by fire in February last, and have established commodious quarters at No. 106 Sudbury street, for the manufacture and sale of all kinds of electrical apparatus and supplies. With long experience in all branches of the business, and new machinery and improved facilities, I am able to offer the highest grade of manufacturing and experimental work at prices as low as consistent with the best workmanship. A fine and varied assortment of electrical goods and all kinds of supplies required in electrical work will be kept in stock."

The Consolidated Electric Manufacturing Company, the successors of the Electrical Development and Manufacturing Company and the Tremont Electric Lighting Company are now well established in their new factory at 355 Congress street, Boston, where they are amply equipped for the manufacture and repair of all kinds of electrical apparatus. The factory is a five-story building, and is thoroughly well lighted throughout, and their machinery is of the latest and most improved pattern. The company are now manufacturing dynamos and motors for arc and incandescent circuits, and are prepared to furnish electric light fittings of all kinds, including Davis arc light cut-outs, hanger boards, dynamo brushes, pole steps, telescope switch board, plugs, fuse boxes, and American arc light supplies. The company are running under the management of Mr. A. R. Brown, who has for many years been identified with the electric light business, and who will make his executive office at Room 7, Cook Building, 149 Congress street, Boston.

The New England Wiring & Construction Company, of Boston, are at present engaged in wiring the following mills and buildings: Talbot mills, North Billerica, Mass., 800 lights; Edwards Manufacturing Company, Augusta, Me., 750 lights; Hollingsworth & Whitney Company, Gardner, Me., 121 lights; Pembroke Mills, Suncook, N. H., 360 lights; Boston Belting Company, Boston, 550 lights; East Cambridge Court House, East Cambridge, Mass., 530 lights; Cobb, Bates & Yerxa, Boston, 200 lights; Cobb, Aldrich & Co., Boston, 200 lights; Arnold Print Works, North Adams, Mass., increase of 150 lights; Young's Hotel, Boston, increase; Parker House, increase. Besides the above ordinary wiring work, they have contracts also for pole line from Woburn to Winchester, Mass., for the Woburn Electric Light Company, and are wiring their new station. They are also wiring the cars for motors and lights, and the car-house for lights of the Lowell & Dracut Street Railway Company, and are overhauling the telephones and fire alarm of the Massachusetts Reformatory, Concord, Mass. Altogether the New England Wiring Company have no reason to complain of dullness this fall, as orders are coming in every day.

Perkins Electric Lamp Company, Hartford, Conn.—The success of the Perkins lamp has been so great that the Perkins Electric Lamp Company have been forced to extend very materially their facilities for manufacture. Before April of this year the Perkins lamp was manufactured by the Mather Electric Company, but at that time the business was growing so much that it was determined to have a separate company, and the Perkins Electric Lamp Company was organized. Commencing with an output of 250 lamps per day, they are now making 1,000 lamps per day, and will increase this number in the near future. It is claimed that the Perkins lamp combines a higher efficiency and longer life than any other lamp, and it possesses one extremely valuable property, in that it does not blacken with age. The lamps are made from 16 to 32 c. p., and from 45 to 110 volts, and are made to fit the sockets of all the principal systems. That the lamp is meeting with marked success is shown by the large number that are being turned out, and from the fact that most of the various systems of electric lighting are using them. The executive office of the company is at 314 Pearl street, Hartford, Conn., and the factory is at Manchester, Conn. Mr. J. J. Gates is the acting secretary of the company, and the Western Manager is Mr. W. G. Halm, 54 and 56 Franklin street, Chicago, who is also vice-president of the company.

Decreasing the Gas Dividend.—Some interesting events have recently taken place at Southbridge, Mass., where the gas company is reported as paying back excess charges to several companies, the result of wrong meter returns, which are excused as errors of the book-keeper; and as, of course, gas meters are always correctly taken, this is probably a truthful excuse, but the little circumstance has been very entertaining to the Southbridge Electric Company, which is a rival in that town in the lighting business. The gas company had at one time an option to purchase the electric plant, in which the Thomson-Houston systems are used, but for reasons best known to itself decided not to do it. The plant then passed into the hands of some of the leading citizens in Southbridge, who have taken hold of it with a will and are making it a success. The gas company has always paid 8 per cent. dividends until last January, when it passed its dividends, but declared 6 per cent. in April. The prominent directors of the gas company have placed many of the citizens of Southbridge under great obligation to them for explaining correctly and exactly the profits which the electric company are making, and showing how utterly impossible it is for the company to do business and make any money; and have pointed with considerable pride to the fact that they were paying dividends and had reduced the price of gas, their last reduction being to $2.50 per 1,000, with 10 per cent. discount on all persons who burn 2,000 feet or over. These same citizens who were told so confidentially of what the electric company could not do and what the gas company could do, are reflecting, since the recent error in taking meters, whether the gas company had actually a thorough knowledge of its own business. A. C. S.

PHILADELPHIA NOTES.

Branch Office of The Electrical World,
31 City Trust Building, Philadelphia, Pa., Sept. 5, 1889.

The Energy Manufacturing Company, 1,115 to 1,123 South Fifteenth street, have issued a new catalogue and price list of their improved rope hoisting machines, which are well known; their friction driven centre grinder, clamping blocks, drill guide and steady rest, and other specialties. A number of testimonials are given from users of their apparatus.

Mr. Geo. W. Lord, of 316 Union street, Philadelphia, has recently issued a circular calling the attention of his customers and others to the injunction lately granted him by the Court of Pleas against a firm who, it is claimed, attempt to manufacture an article under the name of "Lord's Compound." After the twenty-five years Mr. Lord has devoted to the study of the subject, he is able to manufacture a boiler compound with special reference to the peculiarities of the water found in districts of different mineralogical characteristics. His investigations and perseverance ha e won for him and his compound favorable mention in several standard works on steam engineering, and it is therefore not strange that he should use every legal means available to protect his business against infringing encroachments.

Lighting Spreckels' Refinery.—The contract for lighting the Spreckels refinery, at Reed street wharf, Philadelphia, was given last Thursday to Messrs. M. R. Muckle, Jr. & Co., No. 608 Chestnut street, Philadelphia, who will install a 2,250 light plant of the Westinghouse system (alternating), using Westinghouse standard engines to drive three No. 1 dynamos. This plant is for one-half of the refinery, which is rapidly nearing completion. The orders for the second half of the refinery have, I believe, been given out, and the work is to be proceeded with at once. The plans and specifications prepared by Messrs. M. R. Muckle, Jr. & Co., called for a complete central station, the building for which will stand at one end of the completed refinery, and from this mains will be led to each building separately, giving complete control of the entire lighting system of the plant from the dynamo room. It is noteworthy of the recognition by engineers of the importance of thorough installation of electric light plants, that the contract was in this case awarded to the *highest* bidder, after an examination of electric light plants of the various systems by Mr. Spreckel's engineers, Messrs. Watson, Muller and Sieghortner. Those who know those gentlemen will know that Mr. Spreckels could not have placed the selection of his plant in better hands.

Messrs. James W. Queen & Co., the well known and enterprising dealers and manufacturers of electrical test instruments of this city, announce that they have just received large invoices of the Ayrton & Perry direct reading spring ammeters and voltmeters, of which they are sole agents for America. These instruments have had an almost unprecedented sale, and Queen & Co. have found it hitherto impossible to fill their orders as rapidly as they came in. This new consignment, however, covers all ranges of current and voltage, and they think they can now fill their orders promptly. These instruments continue in their popularity as reliable, practical and easily transportable instruments for general testing. A large number of Carpentier ammeters and voltmeters have also just arrived, there being also as large a sale for them as for the Ayrton & Perry. A large number of resistance sets and standards are now being made by Queen & Co. They report that orders formerly given for foreign resistance coils are now very largely replaced by those of home manufacture. They are now making six of their large No. 1 "resistance set and Wheatstone bridge," as designed by Prof. Wm A. Anthony, besides a number of smaller boxes of their own design. A new portable testing set is shortly to be put upon the market, which will have some features of advantage for linemen and electric light experts never before incorporated in a set of this kind.

WESTERN NOTES.

Branch Office of The Electrical World,
39 Mallers Building, Chicago, Sept. 5, 1889.

The Westinghouse Quarterly Dividend of 1½ per cent. was paid by check last week.

The Knapp Electrical Works, Chicago, have secured the services of Charles H. Cone as a commercial traveler.

Mr. John M. Thomas, secretary and treasurer of the Charles Munson Belting Company, has gone East on a pleasure trip.

Ernst Hoefer, Chicago, has returned from an extended hunting and fishing trip through the northeast, braced up for the fall trade.

The Allen Manufacturing Company, Chicago, have shipped two 12 × 14 Valley engines to a San Francisco electric light company.

Dr. C. H. Holmes of St. Louis, sales agent of the Electrical Supply Company, Chicago, made a business trip to the city during the past week.

F. P. Mack, Chicago agent of the Underwood Manufacturing Company, has moved into more commodious quarters at 62 and 65 South Canal street, city.

Mr. W. H. Woodring, manager of the Kansas City, Mo., Electrical Works, attended the G. A. R. encampment at Milwaukee, and en route home visited friends in Chicago.

The Rumsey Manufacturing Company, Detroit, Mich., offer their entire telegraph pin and bracket plant for sale at a low figure on account of a pressure of business in their regular line.

M. C. Chase, Chicago, is manufacturing a special line of small hard rubber goods to order, and has secured the contract for making all the hard rubber knee caps required in the construction of a patented artificial leg.

The Metropolitan Electric Light and Motor Company has been organized at Chicago to manufacture electrical apparatus. Capital stock, $500,000. Incorporators, Samuel W. Adams, Charles S. Raddin and Nathan Whitman.

The Pleasant Valley Street Car Company, Pittsburgh, Pa., will have their system in working order by Nov. 1. The power house is rapidly approaching completion, and will contain a steam plant of a total capacity of 1,000 h. p.

H. E. Teachout, secretary of the Des Moines Electric Railway Company, writes that "we are so well pleased with the Underwood cotton-leather belts, that were we about to equip a dozen stations we would use no other belting."

The Belvidere Electric Light Company, Belvidere, Ill., speak in high terms of the Ellis oil filter they are using, and claim that a company will effect a saving in oil every three months amounting in value to the price of the filter.

The Leonard & Izard Company, Chicago, received in Monday morning's mail no fewer than four contracts for the installation of isolated incandescent plants, aggregating 1,700 lights, and a contract for a small central station plant of 1,100 lights.

The Mechanics' Institute Fair, San Francisco, opened Aug. 27. Among the exhibits are Brush arc and incandescent machines, motors, etc., and a new Brush alternating machine, with apparatus complete, will be placed on exhibition this week.

The International Electric Company, of Chicago, Ill., has been formed for the manufacture and sale of electrical apparatus under certain patents; capital stock, $3,000,000; incorporators, Samuel W. Adams, Charles S. Raddin and Nathan Whitman.

The Central Electric Company, Chicago, are placing on the market a new style of shade-holder designed to fit any incandescent lamp. They are also selling a windlass with crank pin and removable handle for raising and lowering arc lamps at street intersections.

John A. Hinsey, who controls the Milwaukee, Wis., City Railway Company's line, has purchased the property known as the Empire Mills adjoining the station of the Badger Illuminating Company, for $40,000, and will convert it into a power house for the electric railway system.

The Grant's Pass Water, Light & Power Company has been organized and duly incorporated at Grant's Pass, Oregon. J. W. Howard, J. A. Jennings, J. L. Scott, Arthur Conklin, Charles K. Chausler, F. M. Johnson and W. T. Coburn are interested, and propose to install an arc light system at once.

Mr. D. A. Andrews, Jr., of Boston, has thoroughly canvassed the western trade in the interest of Pettingell, Andrews & Company, and has been especially fortunate in securing orders for their incandescent switches and cut-outs from almost every dealer visited, all of whom cordially invited the young Bostonian to call often.

The Postal Telegraph Company are making extensive improvements in their Pittsburgh, Pa., headquarters, overhauling and renovating all the offices, adding more convenient form of

tables and chairs, and substituting three 8 h. p. dynamos for the batteries heretofore employed. Forty operators are now employed in the city.

Oakland and Haywards, Cal., will probably be connected by an electric railway over fourteen miles in length, and which will pass through San Sendo. The interested parties are Thomas Prather and C. T. Palmer, of the Union National Bank, and Socrates Huff, county treasurer, who are examining the merits of the different systems.

The Nutting Electric Manufacturing Company, Chicago, have just installed a handsome arc light plant in a large meat market on Ogden avenue. Being the first electric light plant installed in that section of the city, it has attracted much attention, with many favorable comments. This company also have several of their new motors in operation.

The Rice & Whitacre Manufacturing Company, Chicago, have placed a Russell engine in the electric light plant on Washington street controlled by the National Electrical Construction Company, and have furnished the entire steam plant, including Russell engine, to operate the Edison and Sperry dynamos in Schlesinger & Mayer's retail house.

Minneapolis, Minn., wisely concluded to use the electric light in street illumination during the continuance of the exposition, and has 350 arc lights placed in a double row extending from the bridge down the avenue to Banks street. As the lamps have globes of red, white, blue and green glass, and are only twenty feet apart, the view is exceptionally fine.

The Westinghouse Electric Lighting Company, of Sewickley, Pa., will be in a position to make that pretty suburban town a place of radiance by night as well as day about Sept. 15. A good many of the poles are already up, and the power house has been commenced. The dynamos and engines will be sheltered in an iron building at Fife street and Centennial avenue.

Mr. Robert P. Porter, superintendent of census, is rapidly appointing the necessary special agents for the collection of industrial statistics, but thus far has made no appointment for the electrical field. It is to the interest of every one that this appointment be made with as little delay as possible, in order that ample time may be allowed to prepare for the important work.

Dr. John E. Davies, professor of electricity and magnetism and mathematical physics in the University of Wisconsin, Madison, Wis., met with a sad loss in the death of his estimable wife at Madison, Wis., last week. Mrs. Davies had been an invalid for many years, suffering severely at times, but until a few days before her death there was no indication that the end was so near.

Jayne & Duncan, of San Francisco, have contracted to install the Sprague electric railway system in the California Sugar Refinery Company's plant. The specification calls for 4,000 feet of track, four freight cars, and numerous switches. Overhead circuits will be used, and the cars will be devoted to transporting casks of sugar and other freight from one department of the refinery to another.

Henry B. Slater, of Leadville, Colo., whose interesting contributions on the subject of electrolysis have been printed by THE ELECTRICAL WORLD, has devised a process for the extraction of zinc from silver ores that has proven of great value in laboratory tests, and the commercial application of which is now to be demonstrated on an extensive scale at Leadville, where a special plant is being erected.

An Electric Novelty.—To attract the attention of passers, a Chicago barber has placed a Knapp Electrical Works motor and fan in the window of his shop. Attached to the end of the shaft opposite the fan is an extra pulley that is belted to some home-made wooden shafting and pulleys that operate a number of cardboard representations of men working at the various trades. The current for operating the motor is furnished by the Chicago Edison Company.

The Mound City.—Articles increasing the capital stock of the Mound City Street Railroad Company from $125,000 to $1,000,000 have been filed. The assets of the company are given at $300,000 and liabilities $126,000. Articles increasing the capital stock of the Union Depot Railway Company from $400,000 to $1,200,000 have also been filed. The assets of the latter company are given at $811,000, and liabilities at $351,000. The object of the increase of the capital stock of the two companies is to raise money to change the motive power of the lines named to electricity with overhanging wires.

Incorporations.—The Martinsville, Ind., Street Railway Company; capital stock, $100,000; incorporators, Frank S. Montgomery, J. M. Fry, A. R. Shireman, J. D. Brickert and W. W. Culoner, Crawfordsville, Ind., Electric Light and Power Company; directors, C. M. Crawford, D. H. Jackson, H. W. Ristinc; capital stock, $200,000. The Citizens' Electric Light and Power Company, of East St. Louis; capital stock, $25,000; incorporators, H. D. Sexton, Stephen Sexton and Anthony Isch. Tarentum Electric Company, Pittsburgh; the capital stock is $5,000 divided into 100 shares of $50 each; directors, John H. Humphreys, A. L. Chapman, E. L. Thompson, Charles Biehl and Ellis W. Anchors.

The Des Moines, Ia., Street Car Lines.—An effort is being made, a press dispatch states, to consolidate the two lines of street cars in Des Moines, one operated by horses and one by electric power. The horse car line has been in operation twenty one years, and its charter has nine years yet to run. The electric plant was put in operation last December, and its success has been such that the old line is practically valueless, and is running behind rapidly. Two years ago it was sold to a syndicate composed chiefly of the nephews of Senator Sherman, of Ohio, for $225,000. The electric plant is valued at $350,000, although a year ago it could have been bought for $60,000. The gentlemen interested in the deal have an option on both lines, which expires Sept. 12, at an aggregate price of $600,000.

H. M. Byllesby, Vice President and General Manager of the Westinghouse Electric Company, Pittsburgh, departed on the steamer City of Paris for England on Saturday last, accompanied by a staff of electrical experts and mechanical engineers to build the new works of the Westinghouse Electric Company, Limited. The latter concern was organized some time ago in London with a capital stock of $3,000,000, and while it is to be conducted as an independent company, it is nevertheless a branch of the Pittsburgh works. Before departing Mr. Byllesby said "Since our company started the two central station plants in London of 25,000 lights each we have made rapid strides in electrical work in England. Orders have accumulated in a most phenomenal manner, and the establishment of a company in England was a necessity. The works will be built on the same plan as those we are operating here, and the same kind of work will be done there. I am not a stockholder of the English company, and my mission is merely to get the place in working order, as I did with our factory here. The company has bought a large lot on the York road, adjoining the Westinghouse Air Brake Works in England. The electric works will be a structure of the same kind as the one in Pittsburgh." Mr. Byllesby will be away for over three months. The establishment of the company will amount to about $100,000, and nearly 1,000 men will be employed there as soon as the plant will be in operation. F. DE. L.

ENGLISH NOTES.

[*From Our Own Correspondent.*]

LONDON, August 28, 1889.

The Proposed Government Standardizing Laboratory.—The government standardizing laboratory scheme, which a week or so ago was imperiled by the close-fistedness of the Treasury, now runs some danger of collapse owing to the apparent reluctance of electrical manufacturing firms to supply data with regard to the probable number of meters, ammeters and voltmeters they intend sending in for certification. Without reliable data on this point it is impossible for the Board of Trade to make out as strong a case to lay before the Treasury as the facts warrant. A second circular has, therefore, been issued by the Electrical Section of the London Chamber of Commerce, urging the immediate sending in of the requisite returns. The estimate for house meters, from five sources only, amounts to nearly 17,000 per annum.

Eastbourne and Electric Railways.—The fashionable seaside town of Eastbourne, where the electric light has for some little time enjoyed an assured if modest patronage, evidently draws the line at electric railways. In answer to a well-signed circular, the Mayor convened a meeting a few days ago to consider the question of an electric railway along the sea front to Beachy Head, a fine chalk headland two miles outside the town. Only some 20 persons attended the meeting, and what little life there was in the scheme was immediately extinguished by the announcement of the worthy Mayor that the Duke of Devonshire, who owns the land along which the proposed line would pass, would oppose the scheme at every step. This menace resulted in the prompt dispersal of the meeting, no one being sufficiently venturesome to so much as second a motion in support of the proposed electric railway.

Proposed Electric Railway Between Lanark and Hamilton.—In pleasant contrast to the sleepy "Southron," I hear that the "cannie Scot" has made up his mind to have an electric railway between Lanark and Hamilton, a distance of 15 miles. A company has been formed for this purpose and the capital has been subscribed. The object of the line is to make Lanark, which is a very ancient burgh and popular health resort, more accessible to the people of Glasgow. The distance between the two towns is only 31 miles, but, owing to the meanderings of the Caledonian Railway, the journey is rarely done under two hours, and it is anticipated that the electric railway, by taking a more direct route, and striking the Caledonian system at Hamilton, will effect a great saving of time. The motive power will be secured from Stonebyres Linn, the finest of the falls of the Clyde, which here makes a descent of nearly 80 feet.

Alternate Current Working Controversy.—The publication of Mr. Mordey's paper on "Alternate Current Working," in the *Journal* of the Institution of Electrical Engineers has given rise to a sharp discussion in the electrical press, rivaling in vigor the famous controversy of last year between Dr. Lodge and the older school of electricians on the subject of the behavior of lightning and the efficacy of lightning conductors. Mr. James Swinburne, for instance, takes up a *nil admirari* attitude with regard to Mr. Mordey's striking experiments, and both he and Mr. L. B. Atkinson assert that we have been taught nothing new concerning alternate current working, and that all Mr. Mordey's results are in consonance with Dr. Hopkinson's equations. I hear, however, that Mr. Mordey still sticks to his statements, and intends shortly to give another public demonstration, at the Brush Works, in support of his views as to working alternators in parallel.

The Board of Trade and the Electric Lighting Acts.—The proceedings of the Board of Trade and other government officials under the electric lighting acts of 1882-88 have throughout been characterized by broadness and fairness; and last week, at Southampton, we had a striking instance of the impartial spirit animating those who are responsible for the administration of the acts. The Town Council of Southampton having asked for sanction to borrow £1,440 for electric lighting purposes, were informed that a provisional order must be obtained. This decision, coupled with the insertion in every provisional order of a schedule of streets which *must* within a certain time be provided with mains, effectually prevents our conservative local authorities from excluding electric lighting companies except by undertaking the work in a *thorough manner* themselves. As I have remarked in previous letters, the local authorities are no doubt frequently placed in awkward dilemmas with regard to this new intruder, but the Board of Trade gives them the option of doing the work themselves or letting others do it, and will not permit them merely to obstruct progress.

The Board of Trade Overhead Wire Regulations.—The long-expected Board of Trade rules for the erection of overhead electric light wires have at last been issued. These rules will be enforced wherever overhead wires are permitted, which, as things go now, will not mean everywhere. Whatever the alternate current advocates may say in support of the comparative safety of their system, it is pret'y evident that the authorities in this country, as well as in yours, are by no means inclined to treat continuous and alternating currents as equally safe. In the regulations to which I am referring, for instance, low-pressure conductors in the case of continuous currents mean those whose difference of potential do not exceed 300 volts, but in the case of alternating currents the limit is 150 volts. As we are not likely to witness a low-tension system of distribution by means of alternating currents, this definition is not of much practical importance, except in so far as it shows that the Board of Trade believes in the superior death-dealing quality of an alternating current. Taken as a whole, however, this last official document relating to electrical distribution, which I may mention has been amended by the electrical section of the London Chamber of Commerce, calls for no adverse criticism at the hands of those interested.

THE TELEGRAPH.

Sanford, Ala., will put in an electric fire alarm system.

The Alabama Midland Railroad Company are building a telegraph line to Luverne.

Beloit, Wis., wants an electric fire alarm system. Mr. C. A. North is the chief of the fire department.

Higher Telegraph Rates.—The Western Union Telegraph Company has informed its customers that commencing September 2, rates between New York, Boston and Philadelphia will be twenty cents, and one cent extra for over ten words. This is an advance of from 15 to 33 per cent.

A Message from the "Minia."—A special dispatch from Halifax, N. S., of Sept. 3, says: The steamer Minia has repaired the break in the cable, in west longitude 30.30, and proceeded to England. A dispatch from the Minia in the longitude mentioned says: "The water is about two miles deep in this spot."

THE TELEPHONE.

The American Eophone Company.—Among the new corporations recently chartered under the general laws of Massachusetts is the American Eophone Company, with a capital stock of $100,000. Its officers are Frank Della Torre, President; William DeFord, Treasurer and Frank Della Torre, William DeFord, W. S. Graff Baker, Henry DeFord and O. B. Stillman, directors. The company's headquarters at present are at 35 Broad street, Boston, and its business is to be the manufacture and leasing of the eophone, a new instrument for detecting obstacles at sea.

The National Telephone Exchange Association will hold its convention at Minneapolis, as already announced by us, on Tuesday, Sept. 10, at the West Hotel. To the entertainments already named must be added a lunch to be given on Monday, Sept. 9, at the Chicago Electric Club, by Mr. C. H. Wilson, for the Chicago Telephone Company, and F. G. Beach for the Central Union Company. After the luncheon, the party will be given a drive through the parks and boulevards, being afforded, it is humorously stated, an opportunity of "viewing the site and plans of buildings in process of construction for the World's Fair in 1892." The special train leaves Jersey City at 9:15 A. M. on Sunday, Sept. 8.

Drawbaugh Talk.—The following is from the Boston *Herald* of Sept. 1: Said a party in interest to-day: "President Bartlett, of Drawbaugh fame, went back this morning via Boston to his work and to his labor in New York, after a short vacation, shaking hands with himself. The Drawbaugh leaders have just had a conference and their confidence is unbounded. Mr. Bartlett claims that the nature of the new evidence it is proposed to put into the United States suit against the Bell Company is of such a nature and so conclusive that his people have without much effort secured all the financial assistance necessary for the coming trial; that Drawbaugh matters are now in splendid condition, and, with a case which three of the justices of the Supreme Court believed in and startling new evidence, the outlook for his people is very bright."

The Phonograph in Italy.—Charles H. Wood, vice-consul to Rome, reports to the State Department that Signor Enrico Copello, who formerly resided many years in the United States, has purchased the right to sell the Edison phonograph in Italy. As a preliminary step to this enterprise, the consul reports that Signor Copello visited Rome, bringing with him the first phonograph ever seen in the kingdom. It was exhibited before representatives of the Associated Press, of the Senate and Chamber of Deputies, leading scientists and King Humbert. The King dictated a congratulatory message on the phonograph to the inventor, and requested Signor Copello to carry the Queen Margaret at Venice a phonograph message. The invention awakened great interest throughout the country, the vice-consul says, and the columns of the press are filled with handsome tributes to Mr. Edison and to the inventive genius of the American people generally.

THE ELECTRIC LIGHT.

Picton, Ont., has appropriated $15,000 for an electric light plant.

San Mateo, Cal., wants a small plant. Mr. G. A. Bartlett is town clerk.

The East River Electric Light Company, of this city, has increased its capital stock from $500,000 to $1,000,000.

New Brush Central Stations have been organized during the past week at Waynesburg, Pa.; Barrie, Ontario, Canada, and New Ulm, Minn.

The Kennebec Light and Heat Company, of Augusta, Me., has arranged to increase its capacity by ordering another 45 arc light plant of the Brush system.

Jerome Park, New York.—Pierre Lorillard and associates propose to cover Jerome Park with a glass roof, light it by electricity and use it for winter races at night.

Nebraska City, Neb.—The new Nebraska City Water and Light Company is simply the reorganization of the City Water Company. The new company intends to enlarge its plant by putting in an incandescent system, supplementing its present arc plant. Negotiations are now pending for the purchase of the apparatus. Mr. E. A. Rudiger is superintendent.

Bangor, Me.—The citizens of Bangor, Maine, congratulate themselves on the excellence of their lights. The city of Bangor installed the Brush system of arc lighting some time ago. and the plant was described in these columns. Since that time the city has ordered an additional plant from the Brush Company, and the lights are giving the best satisfaction.

The Pond Engineering Company sold the Fort Scott, Kan., Electric Light and Power Company a 125 h. p. Armington & Sims engine. This is the third engine which they have sold the Fort Scott Company within a very short time. They are also furnishing Guthrie, Chase & Co., Milford, Iowa, a 50 h. p., Schutte exhaust steam condenser complete with all pipe, valves, etc.

Danvers, Mass.—The municipal plant of the Brush system operated by the city of Danvers, Mass,, continues to give the best satisfaction. One thousand two hundred (1,200) candle power arc lamps are used. Recently the city had engineering experts measure the power required for the lights, and it appears that they are operated with the expenditure of a little less than 6-10 of a horse-power per lamp. The lighting committee in its report expresses the greatest satisfaction of this showing of economy and the generally satisfactory working of the apparatus.

Southern Notes.—Orangeburg, S. C., proposes to have an electric light plant.——An electric light plant and waterworks are projected for Weston, W. Va.——Reville & Jounal of Franklin, Tenn., propose to put in a plant of 20 arcs and 200 incandescents, and are ready to receive bids.——Bids for a municipal electric light plant for Romel, Ga., should be addressed to J. C. Printup.——Pineville, Ky., is to have an electric light plant.——Mr. Van Steenberg, representing English capital, will, it is said, buy up the electric light plant and other industries, at Macon, Ga.——An electric light plant is to be put in the Gallatin, Tenn., Cotton Mills.

APPLICATIONS OF POWER.

A Knowing Knife-grinder at Oakland, Cal., runs his sharpening stone with an electric motor.

Atlanta, Ga.—The Daft system has been adopted for an electric road to the Exposition grounds.

San Antonio, Tex.—The Crosstown Railroad Company are to have their electric road ready by November 5.

Sherman, Tex.—The College Park Belt Line Railway Company will begin work on their electric road within 30 days. They have secured their franchise.

St. John, N. B.—As one result of its recent electrical exhibition, St. John, N. B., is to have its street cars run by electricity, and

Halifax, of course, wants to do the same. Mr. A. A. Knudson will have the work in hand.

Berkley, Va.—The electric road at Berkley will, it is said, be built by the Sprague Company. Mr. M. W. Mason is interested.

Macon, Ga.—George F. Work, previously reported as purchasing the Macon Street Railway and to change it to an electric road, will complete 10 miles of electric railroad in one year at an estimated cost of $125,000 if given a franchise. New 40-pound rails are to be laid.

Nashville, Tenn.—The company formed by the consolidation of the Main Street & Lischey Avenue Railroad Company, and the Nashville & Edgefield Railroad Company, will have a capital stock of $300,000 and be bonded for $400,000. Heavier rails will be laid on the Nashville & Edgefield line. The estimated cost of the change to electricity is $100,000.

Jamaica, L. I.—The stockholders of the Jamaica & Brooklyn Railroad Company, which recently bought the franchise of the Long Island Electric Railroad Company, met on Sept. 4 at Woodhaven, and decided to issue $500,000 worth of bonds. Edward M. Field, who is largely interested in the company, said that the $500,000 would be used in developing the property. Just what the plans of the company were, or just how the property was to be developed, Mr. Field did not care to say. The plans were not far enough advanced to be made public.

Motor Company Stops Work.—A special dispatch of Aug. 27 from Peabody, Mass., says: The Robinson-Foster Electric Motor Company paid off its help last night and shut down for two weeks. The works at South Peabody are now in possession of a keeper, placed there by F. W. Prescott, of Boston, who holds a chattel mortgage of $1,000 against the company. The property was to have been sold yesterday, but the auctioneer was stopped by an injunction made by the company at the last moment. It is expected that a settlement will be made. Work was started in April, and 75 hands were employed, turning out 150 motors. Most of these have been put out on trial, but the company hopes to raise money on them and continue business. The stock was floated during the spring, and was bought largely by the wage-earners of Peabody, Salem and surrounding towns, who paid as high as $10 a share for it. The last quotation of the stock was 75 cents, with no bidders.

PERSONALS.

Mr. John Crawford has returned home from Mexico.

Lieut. W. D. Weaver, U. S. N., has just returned from Europe. He spent a delightful month in Paris. He is now stationed at the Brooklyn Navy Yard.

Mr. Ricardo J. Echeverria, a graduate of Stevens Institute and a native of Costa Rica, where his family is old and well known, has gone to San Jose, Costa Rica, where he will represent the Edison and Sprague systems.

Mr. Ralph L. Shainwald, President of the P. & B. Paint Company, has just returned from an extended trip through Great Britain and the Continent. He has introduced the specialty there, and it is already being extensively used in England and France. The company have made an interesting exhibit at the Paris Exposition.

Mr. Geo. W. Patterson, Jr., will be Instructor in Physics at the University of Michigan the coming year. He is a graduate of Yale and a mathematical honor man; subsequently he graduated in electrical engineering at the Massachusetts Institute of Technology, and for one year was Instructor in that institution. Mr. Patterson is now in Russia, but he will return for work in October. His appointment at Ann Arbor has been made necessary by the new course in electrical engineering.

BUSINESS NOTICES.

J. H. Sterrist, Jr., & Co., St. Louis, the Western agents for the Brightman Stoker Company, sold some time ago to the M. A. Seed Dry Plate Company, of St. Louis, one Brightman mechanical stoker for a new boiler they purchased. They have now given the above firm a duplicate order for two more stokers to put under the balance of their boilers. The Cleveland Paper Company, of Cleveland, O., after running twenty-one stokers for several years, have given an order lately for equipping six more boilers with the machines.

Perforated Electric Belts Prevent Air Cushions from forming between belt and pulley. They also run slacker than ordinary belts, with less strain on dynamo bearings and the consequent use of *less oil*.—Chas. A. Schieren & Co., manufacturers, New York, Chicago, Boston, Philadelphia.

Battery Cut-Out.—Attention is called to a simple device for disconnecting gas-lighting batteries if accidentally grounded. It is cheap, sensitive, never needs watching, and has no clockwork to be kept wound. Terms furnished by the Electric Supply Company, of Syracuse, N. Y., No. 105 South Warren street.

Patterson, Gottfried & Hunter (Limited), 146-148 Centre street, carry a complete stock of Brush copper, celluvert fibre oiled paper, hard rubber, rod and sheet brass, brass, copper and iron wire, self-hardening tool steel, set and cap screws, machine bolts, machine and wood screws, taps and dies, files and twist drills, blowers and forges, machinery, tools and hardware, gear wheels, wood pulleys, shafting hangers and belting. General factory supplies.

The Lunkenheimer Brass Manufacturing Company, successors to F. Lunkenheimer (Cincinnati Brass Works), have made extensive improvements for the manufacture of their goods. They have built a large four-story brick addition, and have added 15 new lathes, especially constructed for the manufacture of their improved (S) regrinding globe, check and radiator valves, pop safety valves, sight-feed lubricators, oil and grease cups, also a complete line of engine builders' brass goods. Their capacity is increased nearly 25 per cent., thus making theirs the largest brass manufacturing establishment in the West. They employ over 200 hands. The trade will notice that the new firm are guarding the enviable reputation for excellency of goods that the old firm enjoyed. Those not already using their goods will be repaid by investigating the quality and prices of same. No buyer should be without their 1889 catalogue, which can be had on application.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS ISSUED SEPT. 3, 1889.

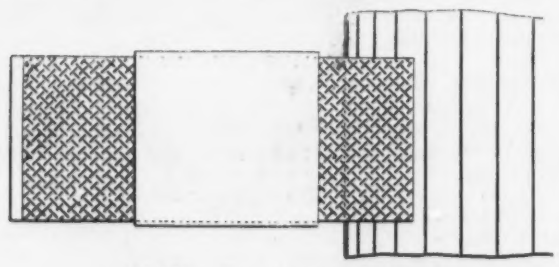
410,150. Electric Conduit; Henry A. Chase, of Boston, Mass. Application filed May 28, 1889. The conduit is composed of a series of castings or supporting frames shaped to form a slot chamber, in which is located the main conductor, an accessible chamber and a power chamber.

410,153. Apparatus for Automatically Charging Secondary Batteries; Stanley C. C. Currie, of Philadelphia, Pa., Assignor to the United States Electric Improvement Company, of Gloucester City, N. J. Application filed Nov. 21, 1888. In an automatic circuit changer for secondary batteries, the combination of a generator, a secondary battery, a main circuit connecting the same, a circuit-making device arranged above a cell of said battery, an electro-magnetic switch adapted to make and break said main circuit, an electro-magnetic signal, and a resistance circuit having contact points to be connected by said switch, the circuit-making device, switch magnet and signal being arranged in a branch of the main circuit.

410,168. Joint for Carbon Filaments; Hermann Lemp, of Lynn, Mass., Assignor to the Thomson-Houston Electric Company, of Connecticut. Application filed Sept. 17, 1888. The invention consists in the joint in which the carbon and the body to be joined thereto are connected by a deposit formed mainly or wholly upon the carbon and extending outward therefrom, so as to embrace a portion of the other body, which preferably surrounds or nearly surrounds the part of the carbon on which the deposit is made.

410,170. Regulation of Coupled Dynamos; Osborn P. Loomis, of New York, N. Y., Assignor to the Loomis Electric Manufacturing Company, of same place. Application filed April 23, 1889. The combination of two or more compound wound dynamo electric machines connected in multiple arc to a common supply circuit, and one or more reactive coils placed in the circuit between said dynamos for regulating the action of one dynamo upon the other.

(1) 410,180. (2) 410,182. Electrically Controlled Elevator; Charles E. Ongley, of New York, N. Y., Assignor to the Hydraulic Elevator Company, of Illinois. Applications filed (1) Nov. 22, 1887. (2) April 18, 1888. The invention consists broad-



410,265. COMMUTATOR BRUSH.

ly in an organized system of electrical connections by which the elevator, having been stopped at any point, will be prevented from starting in the opposite direction. (2) The combination, with elevator car and the mechanism for controlling its movements, of an electro-magnet for operating said controlling mechanism, a circuit closer in circuit with the magnet, and a circuit closer operated by the car to close the circuit through the magnet shortly before the car arrives at a landing.

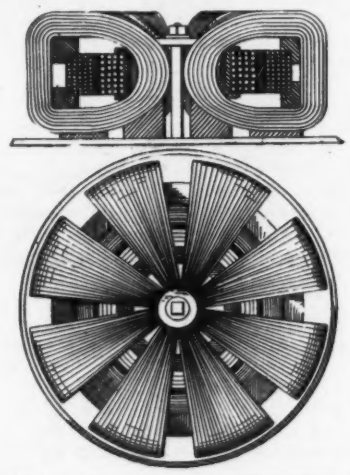
410,183. Electrically Controlled Elevator; Charles E. Ongley, of New York, N. Y., Assignor to the Hydraulic Elevator Company, of Illinois. Application filed July 6, 1888. The combination, with an elevator car, its motor, and the main valve for controlling the movements of the motor, of an electro-magnet for controlling the movement of the main valve, an electric circuit for energizing said magnet, and a circuit closer operated by a moving part of the mechanism to break the circuit through the magnet as the main valve reaches the limit of its working movement.

410,184. Electrically Controlled Elevator; Charles E. Ongley, of Yonkers, N. Y., Assignor to the Hydraulic Elevator Company, of Illinois. Application filed Jan. 22, 1889. The invention consists, primarily, in an organized system of electrical connections by which the movements of the elevator car can be controlled from the landings of the elevator shaft, and also in an organized system of electrical connections by which the movements of the car can also be controlled from within the car.

410,189. Electric Gong; James H. Phalen, of Ansonia, Conn., Assignor to the Electrical Supply Company, of the same place. Application filed Jan. 7, 1889. In an electric bell or gong, the combination of a pivoted armature with a bell hammer shank secured thereto, a contact spring on one side thereof, and an elastic stop in the path of such armature, and which bears against such contact spring.

410,212. Elevator; Rudolph C. Smith, of Yonkers, N. Y. Assignor to Otis Bros. & Co., of same place. Application filed June 14, 1888. The combination, with the cage and starting and stopping device and controlling electro-magnets of an elevator, of circuits including said magnets and extending to the cage and a circuit breaker in two parts, one connected with an operating handle within the cage and the other connected with the starting and stopping device to be moved with the latter to break the circuit as the said device attains its desired position.

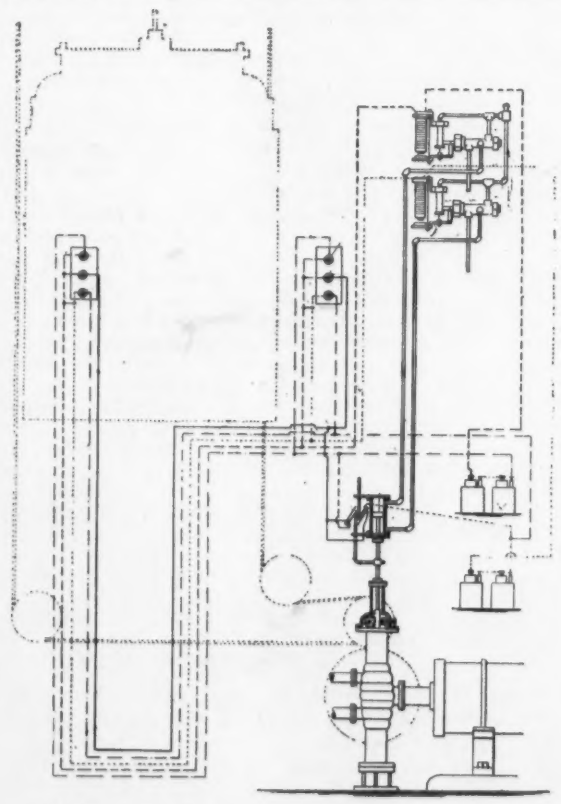
410,264. Electric Railway Plow; Francis O. Blackwell, of New York, N. Y. Application filed March 5, 1889. A contact device for an electric railway, consisting of a traveler forming a mechanical connection with an electrically propelled vehicle, permitting movement of the contact device relatively to the vehicle



410,468. REACTIVE AND INDUCTION COIL.

and a spring contact maintaining a constant electrical connection between a conductor carried upon the vehicle and the contact device respectively.

410,265. Commutator Brush; Francis O. Blackwell, of New York, N. Y. Application filed May 14, 1889. A commutator



410,184. ELECTRICALLY CONTROLED ELEVATOR.

brush composed of one or more layers of wire gauze, having the individual wires in a line diagonal to the axis of the commutator.

410,276. Method of Neutralizing the Residual Magnetism in Electro-Magnets; Frederich Haenichen and Otto Haenichen, of Philadelphia, Pa., Assignors to Themselves and Oscar Seebass, of New York, N. Y. Application filed September 18, 1885. The invention consists in a method of neutralizing the residual magnetism in electro-magnets by the following steps: First, sending a current in one direction through the coils of an electro magnet, so as to attract the armature; secondly, sending a current in a reverse direction through the coils of the electro-magnet, so as to neutralize the residual magnetism of the cores and cause the dropping of the armature and the automatic breaking of the circuit when the complete neutralization of the residual magnetism has taken place.

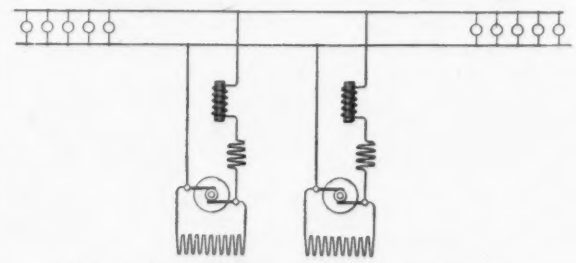
410,293. Pipe-Coupling; Frederick C. Rockwell, of Hartford, Conn. Application filed Feb. 11, 1889. An insulating pipe-coupling, consisting of an exterior shell partly closed at one end, containing an integral mass of insulating composition, which surrounds on all faces and firmly holds a parallel-sided nut of greater diameter than the smaller opening through the shell, and a threaded cap closing the larger end of the shell.

410,318. Fire Alarm System; William L. Denio, of Rochester, N. Y. Application filed July 13, 1888. In a fire-alarm system the combination with a normally closed, but uncharged main circuit and an alarm included therein, rendered operative by a current, of a series of current generators located in the shunt of the main circuit, a readily fusible joint controlling the main circuit between the ends of the shunt, operating when melted by heat to break the main circuit.

410,410. Apparatus for Applying Sheaths to Electrical Conductors; Charles Q. Goodwin, of Malden, Assignor of one-half to Peter B. Wiley, of Wakefield, N. J. Application filed March 30, 1889. The combination of a movable reservoir, fixed guides thereon, a motor whereby the reservoir may be moved upon said guides, a fixed head having a mold communicating with the interior of the reservoir, a guide for an electrical conductor below said mold, and rigid lateral supports connecting the upper end of said guide with the fixed head, whereby the upper end of the guide and an electrical conductor therein are kept at the centre of said mold.

410,468. Reactive and Induction Coil; Elihu Thomson and Edwin Wilbur Rice, Jr., of Lynn, Mass. Application filed April 6, 1887. An electric coil provided with an iron sheath which covers the inner side thereof closely, and is divided externally into sections between which are air-openings communicating with the space between the sheath and coil.

410,493. Electric Arc Lamp; Robert L. Cohen, of Camden, N. J., Assignor of one-half to William F. Anderson, of Philadel-



410,170. REGULATION OF COUPLED DYNAMOS.

phia, Pa. Application filed Sept. 27, 1888. The combination of the upper carbon holder, a pair of gripping levers therefor, the upper arms of said levers having gripping-jaws for engaging with the rod, and having inclined or flaring outer faces, a magnet having an armature with closing plate for engaging with said inclined outer faces of the levers, a carrier for said levers, and stops for engaging with the lower arms of the levers and limiting the descent of the same.

410,498. Tubular Conductor for Electric Railways; Leo Daft, of Plainfield, N. J. Application filed Jan. 7, 1888. An electrical conductor, consisting of two flanged sections, with the flanges clamped together and the opposite edges separated and adapted to receive and retain a traveling contact-piece.

410,545. Cut-Out; Lawrence F. Furlong, of Hartford, Conn., Assignor to Frederick C. Rockwell, of same place. Application filed April 26, 1889. In an electrical cut-out, in combination, a base, two edges of which are provided with wedge-shaped tongues, contact plates with outwardly projecting lugs attached to the base, a cap, two edges of which are provided with wedge-shaped grooves adapted to receive the tongues on the base, and outwardly projecting lugs attached to the cap, so as to make contact with the lugs on the base when the base and cap are slid together.

PATENTS EXPIRED SEPTEMBER 3, 1889.

130,971. Improvements in Electro-Magnetic Watch Clocks; John M. Batchelder, of Cambridge, Mass. The combination of a double electro-magnet and a central armature, carrying a pencil, arranged so that marks may be made upon one side or the other of a central line upon the recording disc.

131,037. Improvement in Telegraph Posts; Improvement in telegraph posts. An iron base piece is provided in which the pole has a seat.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had for 25 cents. Give the date and number of patent desired, and address The W. J. Johnston Co. Ltd., Times building, N. Y.